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ELECTRICAL REVIEW

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The Schuyler System of Distributing Incandescent Lights from the Arc Circuit.

To the purchaser of an electric light plant the problem of meeting the different requirements of the prospective customers, some of whom demand arc lights for the lighting of large areas and general outdoor illumination, and others the incandescent light for stores, factories, private dwellings, and all places where a more complete subdivision and distribution of the light is desired without incurring the great expense of individual apparatus for each description of light, is to a large extent solved by the Schuyler distributor, of which accompanying cuts are given.

In the multiple arc system as put in practice the area supplied from a central station can hardly exceed half a square mile, and the price for the copper conductors is a very heavy item of the first cost of the installation; the energy wasted in conductors can seldom be diminished to less than 10 per cent.; also with a given conductor the greater the number of lamps supplied from the same, the greater the percentage of energy wasted; and in maintaining the difference of potential throughout the system requires electrical apparatus and numerous indicators, and consequently skilled and thoroughly trained employes are necessary, and finally where long distances are concerned lamps of different electromotive force have to be used. Liability to overheating the conductors through short circuits and grounds is also an objection. While the Schuyler Company does not claim that the incandescent light taken from the arc circuit by means of its distributor will in all cases and under all circumstances fill the place of the incandescent lamp when run from a low tension incandescent dynamo, yet they state that there is no arc light station to-day running in the United States that cannot use these distributors in distributing the incandescent light from their circuits to customers desiring the incandescent light, with greater economy and consequently greater profit to themselves than by the introduction of a separate incandescent system.

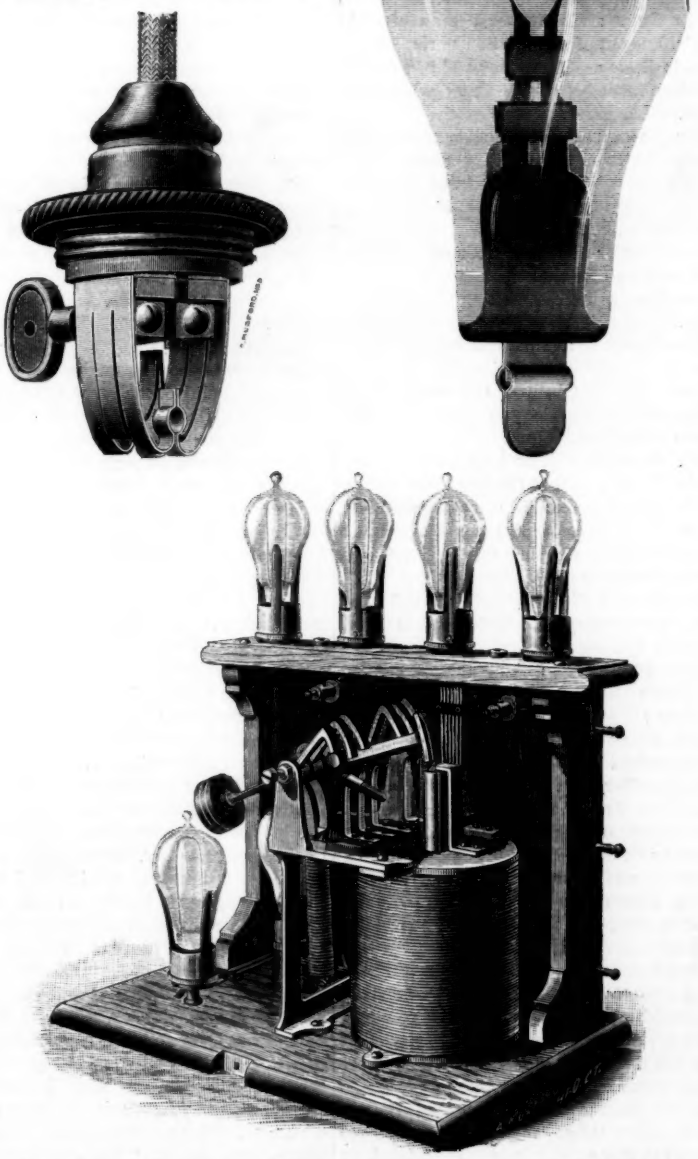
Since the Schuyler Company first commenced the manufacture of these distributors there have been large numbers of them sold to the many local companies using the Schuyler arc system from Maine to California. One company alone is running upwards of 300 lamps from an arc machine on which there are run nothing except these distributors.

While this method of distributing incandescent lights does away with all the disadvantages above enumerated, it is only applicable to such introduction where the customer desires a group of either six or eight incandescent lamps. The company states that the life of the incandescent lamp is as long with this system as with any other, and the number of lamps obtained per horse power is actually as great.

To protect incandescent lamps on the arc circuit from too strong a current, many safety devices have been constructed. In some we have cut-outs which replace the broken lamp with an equivalent resistance coil.

The Schuyler distributor consists of a solenoid of two coils wound in the same direction; one of high resistance connected as shunt to terminals of lamps and the other a low resistance connected in series with the substituting lamps. A movement of the core results in the cutting in or out successively of these lamps, according to the rise or fall of potential. With these distributors the area or district that can be lighted exceeds the largest of city limits. In opposition to the multiple system, the more lights that are used on a given circuit the smaller is percentage of wasted horse power. The first cost of conductors is only that required for the arc light circuit. No regulating devices are required in the central station beyond the automatic regulation of the machine keeping the current constant. Overheating of conductors through short circuits or grounds cannot take place, the consequence of which would only be the extinction of the circuited lights. The charge of an installation of this kind can be given to any man of ordinary intelligence, not requiring any special scientific training.

These distributors can be used by all and any systems possessing automatic regulation, and may be manufactured for any such system and for any required current.



SCHUYLER DISTRIBUTOR AND NEW INCANDESCENT LAMP AND SOCKET.

These devices offer safety and convenience.

We would refer our readers to the description in another part of this issue of the exhibition at the late convention in Philadelphia of the series lamp on the arc circuit, which the Schuyler Company are manufacturing to fill the additional want of customers desiring a less number of lights than the groups provided for by the distributor. A local company with an arc light system supplied with the Schuyler distributor and their series lamps will find but few customers whose wants cannot be met.

Electric Club Discussion.

FULL REPORT OF THE VERY INTERESTING DISCUSSION ON ELECTRIC MOTORS AND THE INSURANCE OF ELECTRIC LIGHT STATIONS, AT THE ELECTRIC CLUB, NEW YORK, FEB. 17TH—ELECTRICITY HUMOROUSLY DEFINED.

We published in the REVIEW last week the papers of Mr. Stephen D. Field, on the "Construction and Operation of Dynamo Electric Motor Systems," and the address of Mr. S. E. Barton on the "Insurance of Electric Light Stations." The discussion which followed appears herewith, and was reported by our stenographer in full:

MR. RIDLON, of Boston, was the first speaker, after Mr. Field concluded by explaining the drawings of his motor, which he had with him, and said: I would like to ask Mr. Field a few practical questions. I am meeting people in the New England states almost every day who have electric light plants or have places for generating electricty. They are also more or less connected with the different horse railroads in their different towns. They are asking me what they can do to dispense with their horses and apply electric motors. What will these people have to do? To what extent will they have to purchase additional machinery—allowing that they can connect with whatever power they have, and whatever electric light apparatus they have—for generating current for motors? Will they have to rebuild their track entirely? Will they have to re-lay their sleepers? Will they have to change the foundations of their roads? Will they have to put in a special rail as a conductor? Will they have to use cogs in connection with that new rail; or what will be the special appliances that they will have to use?

MR. FIELD: That would be a very similar question to what would come up in altering a horse-car road to a cable road. In this case you have to tear up your entire street from one end to the other; and you have got to spend, as I have heard, $150,000 per mile for your conduit and new rails, and everything else. The electric road, I estimate, costs about $20,000 per mile. The motors would cost about $1,000 apiece or less, and you know perfectly well what a central station plant would cost. In order to adapt this to a street-car road already in operation you would have to incur an expense of about $20,000 a mile, and then you would have to pay $1,000 or less for a motor. You could use the same ties, but not the same rails.

MR. RIDLON: They can take their present road bed, and their present ties and re-lay it?

MR. FIELD: Re-lay it with this conduit rail, as I call it.

MR. RIDLON: The same cars?

MR. FIELD: The same cars would do. This gives you the advantage that it is a perfectly smooth and level road bed, and you can drive over it. It would not be objectionable to put up such a road on Fifth avenue, for instance. It would be less objectionable than the present stages.

MR. RIDLON: I want to get at the cost of re laying this rail that is suitable for your system, allowing that the road-bed remains undisturbed, and the tie remains undisturbed.

MR. FIELD: The cost of that will be, as near as I can figure, about $20,000 per mile as against a similar plant for a cable road of similar stability which would cost at least $150,000 per mile.

MR. RIDLON: I can say this: We do not calculate to put in cable roads in the New England States. (Applause.)

MR. FIELD: You are very sensible.

MR. RIDLON: Will your motor admit of attaching one or more loaded cars on an emergency, such as an excursion?

MR. FIELD: The motor shown is six horse power, and it would pull two cars or even three cars, but at a slightly diminished speed.

Replying to further questions put by Mr. Ridlon, Mr. Field said: The weight of the motor will be from 750 pounds to 1,000 pounds. There would be no poles or overhead construction of any kind, and no obstruction of any sort to a regular city street. This rail of copper, which is one inch section, would run the whole length of the rail. If I am working with 1,000 volts potential I have 500 zinc in one conduit and 500 copper in the other.

MR. MASON: Does the cost of the rail include the cost of the copper conductor?

MR. FIELD: That $20,000 a mile covers everything.

MR. POWERS: How are these conduits kept clear of such obstructions as snow, sleet and ice?

MR. FIELD: The snow and sleet are taken care of in this way: If the conductor itself does not become warm enough from the passage of the current to keep the conduit above the freezing point, I carry an inch or inch and a quarter gas pipe through the conduit and circulate it in the engine house through the rear end of the fire-box under the boiler, fill that pipe with salt water and keep circulating that. That will always keep the conduit above the freezing point. Every 150 feet there is a sink trap, and that goes off to the sewer. We have a man to go along there once a day with a hoe that he puts down and draws along the conduit from trap to trap.

GEN. GEO. W. WINGATE: I represent, among other elevated railroads, an elevated railroad which is now about to be constructed. We are just revising the specifications for the construction of 17 miles of railroad. Is it necessary to make any alterations in the plans in order to put it in such a shape that when it is built it can be accommodated to this system without any great expense? Or is it necessary to make any great change from the method of construction such as is in use in New York at the present time? And I would like to ask how the expense of running the cars by means of an electric motor would compare with that of steam? It is expected that the road will be run in connection with Coney Island, and there will be trains of three or four cars loaded to their utmost capacity during the busy hours of the day. We must have something that is certain to go. We cannot have anything where there is any danger of the cars being stopped and the track being blocked. We make no provision for the use of electricity in the future. We would greatly prefer to use electricity, because it goes without saying, that if an electric motor can be had which is suitable for the purpose, and is not too expensive, we will pay even more for it than for steam. If we can use an electric motor which will do away with the smoke and gas and the other things incident to the use of steam, there would be a very great advantage. What we want to know is, can we do it.

MR. FIELD: I should not make the slightest change in your plan, provided it is like the New York elevated road, because that seems to be admirably adapted for an electrical railroad from the very start. It will cost you just about half as much as steam. That is, I will run your road with screenings dumped off a barge into the furnaces, and get you as much power on the track as you can get with steam, using the finest coal. I will get with three pounds of screenings as much power on your track as you will get with probably four or five pounds of coal in the same place. There is a little drawing somewhere about the room for a street car. It is ⅛ scale. If you want to see what it would look like for an elevated road, take that drawing, and instead of a 20-inch driver have a 3-foot driver, and enlarge all the parts in proportion, and you will get very close to the appearance of the article. You would of course have to lay a third rail, bolted to the ordinary sleepers, putting an insulator at about every fifth tie. If the potential carried is so high as to endanger anybody's life, there is nothing easier than to put up a wooden guard on either side, so that nobody can get there unless he deliberately lies down and puts his hand in the slot.

This system has another advantage as against a cable railroad. If you have a cable road and you have what is called a theater car going straight through from the Battery to Harlem, you have got to run 12 miles of cable in order to get that car through. The intention is to build a station at each end of the road. But I do not advise going over ten, or perhaps over five miles without a station. The amount of steam that is blown away from locomotives when they stand at a station is tremendous, and that is all saved with a stationary engine.

MR. RIDLON: We have looked into that fact in Boston. The cable people have been there and have tried very hard within the past year to establish a cable road. There is not a possible chance of their doing it. We prefer to stick to the horses until we can get an electric appliance. (Applause).

MR. FIELD: From what I know of cable roads, it is out of the question to run a cable road in Boston. The cable would be tied in fourteen knots before you knew where you were. (Laughter).

MR. GARRATT: Is it possible to have that central flange on the wheel so small that a man cannot introduce his hand into the slot and ground the current, or poke anything else down there?

MR. FIELD: There is nothing to hinder you from putting a rail across the New York Central track and wrecking a train if you wish.

MR. GARRATT: That was not my question, sir.

MR. FIELD: Oh, you can put it down there. But if you do you would be very apt to take it out again.

MR. GARRATT: How deep is it?

MR. FIELD: About three or four inches.

MR. PENDLETON: Is it not a necessity of Mr. Field's system to have a double track in order to secure a plus and negative current at both ends of the line?

MR. FIELD: Not a necessity; It will come back in the other rail. Each conduit forms a circuit by itself if desired.

MR. PENDLETON: And the other two rails form the plus and minus of the other dynamo?

MR. FIELD: Not at all. You have got your east and west track; the first from Harlem, the other from the Battery, and on the other line of rails just exactly the same way. So you are carrying two zinc conductors up from the Battery. Both the left hand coming down from Harlem would be copper.

MR. PENDLETON: I had an opportunity of examining the cable system of the Third avenue railroad, and I was informed that the total cost of their coal for operating the road amounted to only thirteen dollars and sixty odd cents per day, using screenings, with a tubular boiler. We all know that locomotives require at least 7 or 8 pounds per horse power hour to supply the power necessary to run the trains upon the different roads. Now the advantage of the electrical system in that respect is greatly assisted by the larger return from the large plants which the stationary boilers afford over the fuel carrying system of the locomotive, and the difference between the locomotive boiler and the larger stationary boilers. A short time ago an engineer made an estimate for a cable system for Eighth avenue, and the result of his calculation was a 20 per cent. saving over the cost of horsing the cars. It came to my attention at a time when the matter of an accumulator car was proposed as a test against the cable on one of the city railways, and in formulating a parallel case at extreme figures, the result was that the accumulator car would give a saving of 33 per cent. as a maximum over the cost of horsing cars and at an advantage proportionate to the 20 per cent. which was the calculated saving from the system of cables.

This is the first time I have met with the system proposed by Mr. Field. The subject of electric traction has been a study with me for some years; and the method of using two stations running in opposition as proposed in this system of Mr. Field, some eighteen months ago I realized was the most advantageous system of applying energy to cars by direct transmission. I felt that with the ordinary systems now in use, using current from a central station and dividing it upon a road with ordinary potential of 200 to 300 volts, as has been used, that we could get at least as good a return from the accumulator car, the losses on which are all made in the beginning in charging the accumulators. The losses in the transmission of energy are in the resistance of the circuit. But where there is a division of the potential acting upon the motor in this system of a double station at each terminus, there is an opportunity to operate an electric road at a much longer distance than any other method I have yet met with.

MR. FIELD: The conduit I have here has a square inch of copper. If I recollect right, it would be about one ohm resistance for ten miles. I calculate getting 500 volts there on either conductor. Having 1,000 volts of one ohm resistance, 100 ohms in the motor, it would give me about thirteen electrical horse power, or about six actual horse power to drive the car. In any event, the loss of carrying under a potential of 1,000 volts is so inappreciable as not to enter as a factor in the case at all.

MR. RIDLON: Is it absolutely necessary that you should have a double track, or could you run a single track with a switch?

MR. FIELD: A double track is preferable.

MR. RIDLON: Your current would always be standing on the line, and also on the switch?

MR. FIELD: Yes, sir.

MR. PENDLETON: I would ask how far, in Mr. Field's opinion, the car would be able to run without a loss of 50 per cent.? If it has operated to the extent of even thirty miles without a loss of 50 per cent., it is the first instance of direct transmission that has equaled the use of the accumulator.

MR. FIELD: I think I can put that in such a way that you can see I can beat you. In the first place, I have gone thirty miles while you are getting ready to start. (Applause and laughter.) For every passenger I am carrying, I am not carrying 100 lbs. dead weight that does not pay any fare, which is worse than a legislator's free pass.

MR. PENDLETON: The matter of carrying extra weight, in the opinion of railroad men and experts, is no objection, because it is a well-known fact that a certain amount of traction is necessary for a car. In the relation of losses, I have to say that carrying 100 lbs. per passenger, the necessary amount to operate a horse-car of six tons' weight with passengers, is barely one ton, and the extra ton weight upon any car is no drawback to the car. I recollect that some time ago Mr. Stephenson, the principal of the Stephenson Car Company, told me that he had in many experiments, where he thought success was assured, been disappointed. He showed me a locomotive street car that had been operated upon the Brooklyn railways. He told me he thought that was bound to be a success, and that it was going to replace horses, but it didn't. "Now, the difficulty," he says, "in the matter is that you have to have a certain amount of weight in your car in order to get a grip upon the rail. Unless you have that weight, your car will slip." The other objection which his experience brought forward was that a motor, or any engine subjected to the pounding of the track, was sure to get out of order in a very short time, and it must be protected in some way from being subjected to the variations of the track, the jumping of the ends of the rails, and, as he called it, the "pounding," which would put almost any engine out of order. Whether steam engine or electrical engine, it is the same thing.

MR. MARTIN, at this point, gave the cost of running said steam car on the Brooklyn road as $6.50 to $7.50 a day, doing very light service.

MR. PENDLETON: A short time ago I referred to an interview I had with the president of one of the city railways operating a cable railway on part of their road, which I was informed cost them a million and a quarter of dollars to use, and they were running that station at a cost of thirteen dollars and sixty odd cents a day for coal, using screenings of course, and having ample boiler capacity. That was the Third Avenue Railroad. I see since, in the papers, that there is some talk about their continuing this cable railway the full length of their road. In the interview with Mr. Lyons, the president of the road, I showed him that the rail way could be operated from 125th street to the City Hall and back by electric power at one-half the cost of first plant, and at an economy greater than any cable railway could offer him; and on my figures, after an interview of two hours, he made me this offer: "If you will build us a car and put it upon the railway to run from 125th street to the City Hall and back, and when you have reached 125th street duplicate your accumulators within a reasonable time, and make the trip over again, I will propose to my directors to adopt that system for operating this road." (Applause.) I am building the car now.

MR. GARRATT: In regard to the distance at which such a road could be operated, perhaps we have been laboring under a slight misapprehension. For instance, the north rail was at 500 volts positive potential and the south rail at 500 volts negative potential. The falling off of potential on one rail would be precisely proportional to the increased gain upon the other. Hence, the strength of potential between the two would have to be exactly alike at all portions of the circuit. Do I understand you to say that?

MR. PENDLETON: The loss with the resistance of the length of the line.

MR. GARRATT: That is a very easily calculable quantity, if any of us here could only state what the falling off of potential is.

MR. FIELD: It would be in proportion to the resistance, would it not? The resistance would be about 1 ohm. The loss is so slight it ceases to be a factor.

MR. GARRATT: The loss is so slight that it ceases to be a factor, and I don't know how to calculate it.

MR. FIELD: There is where the advantage comes of using two conduits. It gives you a subdivision you cannot get in any other way.

MR. GARRATT: I admit that. There comes back the question I brought up, that at all times everybody's hand is within reach of 500 volts of electromotive force.

MR. SHARPE: Mr. Edgerton intended to be here to take part in this very interesting discussion. Unfortunately, yesterday he was compelled to leave home on receiving a telegram of the death of his sister. I would like to ask Mr. Field if he has made his calculations in turning short curves. I see you have placed your wheels very near the ends of the car. Don't you think in going around curves that the wear and tear is very much greater than if you had them placed in a square near the center of the car?

MR. FIELD: I will have to explain that to you. The car can be turned around in its own length.

MR. SHARPE: Are you sure of that, Mr. Field?

MR. FIELD: Perfectly sure of it, just as easily as a wheelbarrow. The rear truck consists of four wheels, you see, turning on a king-bolt in the middle. It is a double truck at the rear. When I strike a very sharp curve, you will notice that I have two treads on the wheels; the inner tread is smaller than the outer. All I have to do is to elevate the inner side of the conduit and turn the curve on different sized wheels, the smaller on the inside of the curve.

MR. PENDLETON: As the gentleman is

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from Philadelphia, I would like to remark that he cannot expect to catch Mr. Field on little mechanical devices.

MR. SHARPE: You made a statement, Mr. Field, that people must not expect to get very much energy from a motor by using a small amount of wire and a small amount of iron. What would you consider a small amount of wire for an armature and fields?

MR. FIELD: That is a question that I cannot give you an intelligent answer on. Light weight per horse power is no proof of efficiency to me. I have recently seen a dynamo working wherein the wire in the armature seemed cool, the wire in the field cool, and the iron in the field magnet became very hot, apparently showing that there was not iron enough there for the wire, and that the supersaturated magnet would get hot. It would not be apparent in an ordinary form of dynamo, but it is apparent in some experiments made by Mr. Eickemeyer, of Yonkers. It did not take any time to get hot. A hot blast of air came out of the machine almost immediately on starting. If you make a small motor, you are going to get supersaturation, heat and low efficiency.

MR. SHARPE: Do you think it is practicable to put one motor on a car, and draw one or more cars without a motor being attached to the other cars?

MR. FIELD: If you have iron enough to take up your magnetism, as you go slower and slower, you can pull the whole world.

MR. SHARPE: Wouldn't you increase the number of horse power?

MR. FIELD: Not a bit.

MR. SHARPE: Would you expect a motor of 6 or 6½ horse power to pull two or three other loaded cars besides?

MR. FIELD: It would pull them at a very much lower speed. By making the motor large, and putting in plenty of iron, you can pile up a lot of snow in front of it, if you like, and though it will go slower, it is bound to get there.

MR. SHARPE: You know most railways in cities are run on schedule time. It takes them about one minute to run a square or block—forty squares in forty minutes. They must make that time if it is possible, unless they have a fire or something of the kind. But on an ordinary working day they must make that time. Now, if you were compelled to have one or more cars running on that same amount of horse power, don't you think you would soon have a block on the road?

MR. FIELD: Possibly I should.

MR. SHARPE: Wouldn't you insist on each car having its own motive power?

MR. FIELD: Certainly I should; or else I should wind the motor for one car to pull another.

MR. SHARPE: Then I should consider the plan of hauling one or more cars without a motor on those cars impracticable.

MR. FIELD: It would not be of general adoption.

MR. POWERS: There was one matter which came before the Electric Light Convention at Philadelphia, which occupied a good deal of attention. It was the relative merit of the two systems of electrical distribution known as the parallel or multiple arc system and the series system. The objection raised to the multiple arc system was that the plants of to-day could not be operated on that system; that the electric light companies were operating largely arc light machines, and that they wished to do a motor business. I had just previous to this dinner a short discussion with Mr. Field on the subject of regulation for speed of electric motors placed in series on arc light circuits or on special circuits run by arc light machines. It would be a great favor to the members of the Electric Light Association here present, if Mr. Field would give us his views as to the possibility of obtaining with motors in series a nearly perfect speed of regulation which would enable us to operate motors for ordinary mechanical purposes on special lines or on their arc lines. (Applause).

MR. FIELD: I instance in my paper the way that I would build the motor in order to accomplish that result. I also stated that it had been found impracticable to work motors in series on high potential circuits, for the reason that there was a reactionary effect that took place. I analyzed that little problem and came to the conclusion that it was exactly the same kind of a proposition that would be found if you had a quantity of pendulums connected together of varying lengths governed by electricity from one master pendulum that had a much slower time than all the rest of them. Then I found that the way to correct that was this: Suppose you have your circuit, and you have a dynamo, which possibly for the purpose of illustration we will call a separately excited dynamo. You place in that circuit a current governor which will be infinitely more rapid in operation than your generator or attached motors. It will automatically respond to every change in the current, preserving that current absolutely uniform in the wire. That is, if one motor has a little more current than it needs the regulator comes in and practically instantly reduces the amount on the line afterwards reacting on the generator. For a long time I could not see any way to build such a current regulator; but I have one in operation which I am going to put in my motors on the elevated road, upon which you can put on the largest current you have in New York and in the one-hundredth part of a second diminish it to nothing at all—cut it off entirely without a spark without any trouble. That is done in such a simple way that I am almost ashamed to speak of it. I take a square box, the one I have is about two feet square, and about an inch broad. I cut a slit from top to bottom in that box and pack it in rubber; then on either side of the box put an unoxidizable metal plate clear up to the top, fill that box with an acidulated solution which has no appreciable resistance, put a glass plate in the rubber slit, and the current is gone in an instant. It works charmingly. (Applause.) The objection raised to that would be that the additional resistance in the circuit would give you resistance to be worked over that would be called an expenditure of power for which you get no return. This works instantaneously. Coupled on to it I have put a slowly moving switch which acts after the quick regulator and reduces the generator.

INSURANCE OF ELECTRIC LIGHT STATIONS.

MR. S. E. BARTON, of Boston, was introduced, and after addressing the Club (as published in full in our last edition), explained a small colored insurance chart, as follows: I have here a chart, gotten up by the *Insurance Chronicle*, I believe, which shows in blocks of comparative sizes the fires as reported by the newspapers, from different causes, in dwelling houses. Of course this will not be a fair comparison for electric light fires, because the electric light is not introduced into dwellings so generally as into stores and manufactories. You will observe that the largest space here represents fires from "defective flues." The next one is "incendiarism." In my opinion if one half of the block representing defective flues were added to the one for incendiarism it would be nearer the truth. The next on the list is "matches." Perhaps there ought to be a block put in between these two called "friction;" that is where a thousand dollar policy is rubbed against a five hundred dollar house. (Laughter and applause.) Another block represents "explosions of lamps;" another "forest and prairie fires." This space represents "carelessness,"—probably explosions of lamps, the turning off of gas jets, or something of that kind. The next one just below it represents "gas jets." There is one for "lamp accidents," not explosions. There are accidents not otherwise reported, open fire-places, fire-works, explosions of oil stoves, stove pipes, furnaces, hot ashes, candles, locomotive sparks. When you supplant the locomotive with the electric motor we will rub out that mark. (Applause.) Defective heating apparatus, cigar stubs, commonly known as "snipes;" fire crackers; tramps; thawing water pipes; ignition of grease and oils; oil accidents, not explosions; explosions of gas; ignition of tar; plumbers' furnaces; drunken men; explosions of natural gas, which is a pretty good sized block, considering it is only used in a small extent of territory; bonfires; children playing with fire; explosions of gasoline; defective lighting apparatus. Possibly that may be meant for electric lighting. More probably it is not. But on that whole list that is all that can be charged to electric lighting.

MR. PHELPS: Does that scale represent the number of fires, or the amount of losses?

MR. BARTON: This chart is supposed to represent the amount of losses. It of course is based upon the newspaper reports, and it is quite as likely to be correct as incorrect, I presume; although I do not think the newspapers always report fires correctly. For instance, the first report of the recent fire in the Providence Electric Light station gave as the cause of that fire that the room was filled with the vapors of electricity, and a spark from the dynamo exploded it. (Laughter.) Later on it was attributed to a gas explosion caused by a spark from the dynamo. I do not know as to that theory. Possibly the gas may have been there. If it was there I do not think a spark from the dynamo ignited the gas. We hear of a great many cases of fire from lightning, but I think I am safe in saying that not in one out of a hundred cases where buildings are struck by lightning does fire ensue.

One thing you have to overcome is the great prejudice of insurance companies against the insurance of electric light stations. Now I represent three large companies, the Royal, of Liverpool, the London and Lancashire, of Liverpool, and the Pennsylvania, of Philadelphia. Notwithstanding I am chairman of the electric light committee, and believe thoroughly in electric lights, my companies won't insure dynamos. I had an opportunity not long ago of taking a risk of $25,000 on the dynamos and electric apparatus of my friend Sawyer in Portland. I knew that my companies had declined it before, but I said to Mr. Sawyer: "I will go back to Boston and see if I cannot talk them into taking the risk. I know your money is good. I once won a jackpot from you. (Applause). I mean the quality of it." I went back and told them all about it. They listened very patiently. At the conclusion of my remarks the manager said: "Do you know what electricity is?" I said: "No, sir; I do not." "Well," he said, "all right; until you can tell me what is inside of a dynamo, I won't insure it." Since I have been to Philadelphia I have found out what electricity is. There is one man in the business who knows, but it is hard work to get him to tell. That is our friend Slattery. We got him partially paralyzed—polarized, I mean—the other night, and while in that condition we worked our magnetism upon him and got the secret out of him. But it was so abstruse we have all forgotten it.

Calling to mind the very fine remarks of our friend Dr. Moses this morning, I hope the day is not far distant when all the coal and all the natural gas that is burned to make steam will be burned to make electricity—or used to make steam for the purpose of generating electricity.

MR. PHELPS: Will Mr. Barton permit me to ask him whether the insurance exchange has passed any final judgment as to the cause of the fire at the Providence station?

MR. BARTON: The New England Exchange has not taken any action. I do not know that many of the members know much about it. Our inspector, Captain Brophy, went there immediately after the fire, at my direction, and he stayed there until the plant was put in operation again. It is his opinion, and I believe it to be the correct one, that the fire was caused simply by the lamp being trimmed. That morning they put on the floor four barrels of sawdust to absorb the oil, and it is probable that the man pulled out that point of carbon and threw it over his shoulder. The fireman was badly scalded, and I never knew of gas scalding a man. The theory is that he rushed in and endeavored to stop the engine, and the oil cup or something exploded, and he was scalded with oil or something else. It seems to me that that theory is much more probable than the gas explosion theory, inasmuch as the boiler room is intact, the whitewash is not discolored, and the windows were not blown out of the building. The fire seems to have been about one dynamo that was not running, and near where this lamp was burning with no globe on it. I think it is just as important to keep globes on lamps in a station of that sort as in a dry-goods store, especially if you have sawdust on the floor, and I think if you have sawdust on the floor it is better to use asbestos sawdust than yellow pine.

MR. RIDLON: It seems to me, Mr. President, since our connection with the insurance interest has been established by our friend Mr. Barton meeting us here to-night, that it would be well to continue in this way. Let us meet together as often as once a month. Let them choose a committee and let us choose a committee. The greatest difficulty with electric light plants is the want of proper workmanship. Now, why not put our workmen on the same footing that they put engineers? Why not have a board of examiners, by whom the wiring men and electric light men who are sent out to install plants could be examined in regard to their qualifications for the work of installing plants? And when they have passed that examination let them be given a certificate. I think that would be largely to our benefit, and certainly promote a great deal of confidence amongst the insurance men.

MR. UPTON: Before dropping the subject I would like to revert to what Mr. Barton has said about the explosion at the Providence electric light station, and to call on Mr. Robinson to talk to us about that. He was there the morning of the explosion.

MR. ROBINSON: The opinion I have formed as to that occurrence is simply my own opinion, and you will have to take it for what it is worth. I went to the room through the courtesy of Mr. Barton's agent and looked the matter over thoroughly. They were burning under the boilers, for the first time, soft coal. Of course changing from hard coal to soft coal they created too much steam. The dampers were partially closed. Directly over the belt hole, through which the belt went from the dynamo room to the floor above, was a few feet of space. At the side of that was the store-room of the electrical apparatus, globes and so on, and there was paper on some of the globes, straw on others. There was a slight partition of board. There was but one globe broken in the whole of that fire either by water or by the fire. Not a particle of paper was burned. In the top story, over near the far corner opposite a window which was open at the time of the fire, flexible gas tubes were hung on nails to dry. Those gas tubes were burned about 4 inches below the nails. That would be probably 8 feet from the floor. Below that not a particle of burning was seen. They were not even charred. Above that the woodwork was charred. It seemed to me that there could be no other way than that the fireman had closed his dampers so that he would not have so great a draft, and of course during the early morning hours he needed less steam. The door from the boiler room into the dynamo room was open. The wind from that side blew in there. The belt carried the gas from that upstairs, and except in that far corner opposite the open window where the draft would come in and blow the gas there, there was nothing burned in the top story. Away from where the draft could blow the gas over the dynamos, they were in good working order, although they did not start them up at that time. I candidly think that if they had been allowed they could have started up a majority of the dynamos the next night. (Applause.)

MR. BARTON: Mr. Robinson's idea is of course simply a theory, just the same as ours is. As I said before, it will probably never be known what the cause of the fire was. I personally could not see any strong indications of a gas explosion. I have seen a fire go from the bottom story to the sixth story of a building without burning any interven-

(*Continued on page 7.*)

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We invite correspondence from Electricians, Inventors and the Telegraph and Telephone fraternity and those engaged in Electric Lighting on matters pertaining to electrical and scientific subjects, and all facts of special interest in connection therewith.

We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.

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Frank M. Gilley, 54 Equitable Building, Boston, Mass., is our New England representative.
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NEW YORK, MARCH 5, 1887.

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In the Indiana Legislature the bill repealing the obnoxious bill has passed its second reading in the Senate, having passed the House previously, and there is good reason to believe that, within a week or ten days, the embargo will be removed, and the former status restored.

The longest span of wire in the world is used for a telegraph in India over the River Kistnah. It is more than 6,000 feet in length, and is 12,000 feet high.

The lately published reports concerning the adoption of the cable system by the Third Avenue Surface Railway, we learn, are not so conclusive as has been stated, as negotiations are pending for the trial of an electrical system, operated by accumulators.

The REVIEW office is adorned with a very perfect crayon drawing of Prof. Morse, the work of Artist E. G. Cole, of 262 Cumberland street, Brooklyn. The picture, which is elegantly framed, was finished for Supt. Fred. Mason, of the Police Telegraph Department of Brooklyn, and to his thoughtful kindness is the REVIEW indebted for it.

One of the most beautiful and elegant mementoes we have seen designed in connection with the Bartholdi statue is the one from the American Electric Manufacturing Co., showing the statue of Liberty on an elegant silk banner. It is in all respects a most complete and artistic piece of work, and President Goff has our thanks for the one sent to the editor of this journal.

There are many dynamos scattered throughout the country, which, when in action, give off unpleasant induction or static sparks, when the hand or other parts of the person are brought within an inch or so of the frame. If the field is not properly insulated from the frame, this spark on a poorly insulated line would be dangerous, for it would be a leak of line current; but under the circumstances above, it may be readily got rid of by attaching a wire anywhere on the frame, and carrying this to a water, gas, steam or waste pipe. That it is only a static charge is readily proven by holding the hand firmly upon the frame. It is a leyden jar—nothing more. An incandescent lamp may be charged from such a dynamo, but the experimenter wants to be careful not to take too much at once. Go slow at first, and save disappointment.

SAFETY FOR THE TOWER MAN.

The especial risk which pertains to tower electric light handling has been repeatedly brought to the attention of the companies throughout the United States and Canada, because of the peculiar conditions. The individual who climbs an iron tower to remind a light that it is not doing its duty and to coax it into doing better, under ordinary circumstances is almost as completely on terra firma, electrically speaking, as if he stood in a pool of water, at the foot of the tower. The tower is a perfect and complete "ground." The Detroit company has on several occasions been forcibly reminded of this fact, three deaths from electricity having occurred there during the past year. The danger is so thoroughly understood that before accepting employment the applicant signs a contract waiving for himself and heirs any claims he or they might otherwise be entitled to, on account of accidents which might befall him.

There is probably little doubt that the casualties spoken of resulted from that carelessness which is the result of intimacy with danger. Every tower man is furnished with rubber boots and gloves, and is instructed to stand on either a dry board or glass insulators. But they will not do it. The same spirit of "dare" which induces a boy to slide over an ice covered pond which will barely hold his weight, in a game of "ticklish bender," ignores the use of boards and rubbers and glass, as puerile and childish.

The necessities of the case, however, have brought the remedy. Hereafter the man who climbs those towers will be refused all insulating contrivances, but will, instead, wear a pair of easy-fitting metal bracelets, from which wires will run up his sleeve, under his waistcoat, and thence downward between his outer and inner garments to his boots, and to iron plates on the soles and heels of these.

Where the great danger then lurked, in standing on the iron, is now the most perfect safety for the trimmer. He is protected because the wires, if of sufficient capacity, will carry the current around or past instead of through him.

PRACTICAL WORKERS IN ELECTRICAL SCIENCE.

There are not a few men engaged in practical and scientific improvement who failed to secure in their youth a so-called liberal education. Of the scientific professions they know nothing, except through the published papers and books, and these are studied carefully. A professor of some science works on some line of investigation, and from time to time publishes a report of his work. He has little to spur him on; he has the benefit of the advice, criticism and comment of others; his time is unlimited, he need not hurry his work. Six—seldom more—hours a day for five days in the week, and for thirty-five to forty weeks in the year he gives instruction or pursues his work of original investigation. With a secure position, the doors of the best society thrown open to him, he ought to be able to do good thinking. Let us not disparage the work of such men; they have accumulated information which less favored and less polished intellects often turn to some public good. The number of original investigators in our colleges and universities is much too small. We are far behind Germany and other nations. But let us not forget those (and they are not few) whose only title is "Mr.," and degree that of a freeborn citizen, whose education that of the common school, whose polish that of a man, who has done work for the advancement of science, mentioned in some patent it may be, but at once put into practical use. These men often work daily from ten to fifteen hours. They may not understand the method of least square, or the functions of complex variables, but they do know how to improve mechanical, electrical and chemical methods and machines, and sometimes produce a machine, the working of which is a witness of the error of some professor. Professor Lovering, of Harvard University, in a lecture before the Lowell Institute, many years ago, said that it was impossible to transmit signals through the length of the Atlantic cable. The cable worked, nevertheless. Another scientist, in the early day of electric light experiment, claimed that the new illuminant could not compete with gas under any circumstances. Another professor, and one who is an excellent writer on practical subjects, severely criticized the construction of a certain dynamo which has been proved to be a success. Honorary degrees, election to learned societies may not be given to practical investigators of the present day, but the time will come when true worth and industry will be reckoned at its full value.

THE TELEPHONE ARGUMENTS.

Mr. E. N. Dickerson has added even to his own great fame as a patent lawyer by the masterly argument he has made before the Supreme Court of the United States in defense of the Bell patents. It was a unique effort—characterized by all of Mr. Dickerson's felicities of statement, acute analysis, sweeping logic and power of driving home his conclusions. A single paragraph from this brilliant argument, which we copy under the head of "Public Opinion," will interest even those readers who know little of the merits of the telephone litigation. It is a severe and caustic, but just, arraignment of our Pan-Electric "Department of Justice," and will carry conviction to most fair-minded and intelligent readers.—*Mail and Express.*

It must not be forgotten that the clear, lucid, convincing and comprehensive address of Mr. J. J. Storrow, attorney of the Bell Company, is also deserving of particular mention. Messrs. Storrow and Dickerson constitute a conspicuously able and successful legal team that has rendered most valuable service for the Bell Company's interests.

BOOK REVIEW.

"Elementary Ideas, Definitions and Laws in Dynamics." E. H. Hall, Instructor in Physics, Harvard University. Cambridge: C. W. Lever.

This pamphlet of 37 pp. gives clear and interesting explanations of weight, inertia, mass, units of measurement, work. Nowhere have the reasons for the adoption of the c. g. s. system of units been so clearly given. The author ably defends his definition of inertia, though we fail to see wherein it differs from his definition of *mass*. Practical men, who rightly reject many scientific publications as unintelligible, will find this a help to them in beginning a course of technical reading.

CHICAGO ELECTRICAL NEWS.

Once more the silent telephone man has made his appearance. In some shape or other this form of great and original telephony, which consists mainly in placing the transmitter—in this case the receiver—against the throat, breast or back, between the shoulder blades, where the vibrations reach it without being actuated by air vibrations direct from the mouth: and it may be readily understood that the farther away from the original impulse, or the thicker the medium between the vocal muscles and the transmitter, the feebler the result and the less the value of the fact accomplished.

There have been no less than a dozen or so inventors, each of whom either tried to make himself or some one else believe that this was a wonderful and valuable discovery; and in nearly all if not all cases, those pieces of silver which are made at Philadelphia and in some other cities of the Union, whereon a hen hawk with upraised wings avows its faith in a blessed hereafter—that form of reward has failed to repay the inventor for his labor. It makes no difference, however. He still comes, like the burdock and the thistle, and the cress, to cumber the ground where labors the honest husbandman in the fields of invention.

Why? The world is on the make, to put it in slangy form. See how it is in electric lighting. Not a week passes but some new, better, best form of apparatus comes to light. A system of overcoming the impossible; in insulating in circuits, in cut-outs, in distribution, in anything that the electric light people want, to supply the needs and demands of the dear people.

They appear in the gray of the morning,
They are bought and set up by high noon,
They are gone by sundown, and the inventor, too, has departed, followed by the blue whirlwind which envelops the fervent remarks of the ingenuous purchaser.

Here is another "only and original invention." A chap down South recently got the ear of a reporter, and informed him that he had just discovered how to put an incandescent lamp into an elevator. It had never been done before, and he alone was the owner of the scheme, which had cost him several days in canvassing methods, before he hit upon the simple plan he finally adopted. He wound the wire round a rubber tube—an old gas hose—and attaching this to the elevator at the top, ran the wires to the lamp in the elevator, and the hose rises and falls with the elevator! The enthusiastic reporter says of it that it "is not only an improvement, but a saving in the first cost as well as in the subsequent gas bills, and adds another to the list of uses to which electricity is applied." From the fact that the inventor received a nice little sum for the application, it is just possible that the reporter and others may have struck a simon pure electric light sharp out of a job.

As this letter seems destined to be largely made up of frauds and deceptions, one more may be added right here. Among a lot of scientific notes in a daily occurs the following conundrum:

"The first case of use of electric light in lighthouses in England is on the Firth of Forth, where it has been recommended by the Commissioners for the Isle of Man. The light is equal to 3,000,000 candles, and will be generated by two sixteen horse power engines, driving two dynamo machines. The engine house is some 900 feet from the lighthouse and is connected by systems of copper rods one inch in diameter, protected by an insulated groove along a low cement rubble wall."

There is a class of electric light men who have been called electrical stock raisers, from the facility with which they raise the horse power—on paper—of their contrivances. It is more than an even chance to bet the above chap is one of this class of dealers.

Two 16 horse power engines = 32 horse power.
Pretend that 1 horse power = 2,000 candles.
Then 32 horse power × 2,000 = 64,000 candle power.

An Irishman on a corner was calling out and selling "hot opple poies."

"Here," said a victim, who had bought one, "these pies are made of dried peaches, and they are cold at that. Why do you call them hot apple pies?" And the Irishman was kind enough to reply :

"I don't care a hotel Dam! That's the name of 'em. Hot opple poies! Hot opple poies!"

As Falstaff has it : "Lord! how this world is given to lying!"

The Van Depoele Electric Manufacturing Company are just completing a 250 horse power generator for their Montgomery, Alabama, street railway system. The monster has been christened "Giant," and the writer stands its godfather.

The Chicago Council has been besieged by the gas companies to renew light contracts for another term. They didn't renew, but decided to wait a little and see what possibilities there may be in some other method of lighting. Whether this is to be electric or what is unknown just yet, but the probability is that the "what" will be behind in the race.

There is a Firemen's Pension Fund bill before the Illinois Legislature, which, if passed, will redound greatly to the credit of Prof. J. P. Barrett, superintendent of the City Telegraph of this city. The Professor has taken a lively interest in the bill, removing many knotty points from the original, and it is believed that in its amended condition the bill will shortly become a law; it is a necessity, and every effort will be made to accomplish this end.

And that reminds that the Professor is booked for the Fifteenth Annual Convention of the National Association of Fire Engineers, which meets at Atlanta, Ga., on the 20th of September next. He is to read a paper on "How to obviate the danger emanating from overhead electric wires."

In our Legislature there are already four bills for the regulation of telephone charges and a few county precincts yet to hear from. There is, however, a "masterly inactivity," which seems to possess them all, and little danger is apprehended by the telephone people.

CHICAGO, Feb. 28, 1887.

BOSTON ELECTRICAL NEWS.

Friday evening during the severe gale the chimney of the Edison Illuminating Company at Brockton blew down. The service was not in the least interrupted, as there was sufficient draft to keep the fires burning till the spare boilers connected with another stack could be fired. It would seem desirable to have a steam blast as an auxiliary.

During the past year the physical department of the Yale scientific school has received as an addition to its apparatus a dynamo-electric machine from Edelmann, of Munich. It is driven by a four horse-power engine in the department of dynamical engineering. The winding of the machine is so arranged that a current of 11 amperes and 80 volts or 22 amperes and 40 volts may be obtained. In the engine room are a Charpentier voltmeter and ammeter. An electric bell in an independent circuit from the lecture room admits of easy communication with the attendant in the engine room. A tangent galvanometer with coarse and fine winding has been reconstructed from one of German make. The old needle has been replaced by one of one-tenth the mass and the pointers of fine aluminum now move over a mirror bottom of the compass box.

The gas companies have for years been a power in Massachusetts: legislation in their favor has been passed almost yearly by the general court. The law prohibiting more than 10 per cent. carbonic oxide in illuminating gas was passed at their solicitation to prevent competition from water-gas companies, and they have been successful in this. Up to within a year it was hard to find a single man interested in the manufacture of coal gas who would not deny that electric lighting did not pay. Now all is changed. They wish to enter upon the business themselves. The bill presented by Treasurer Greenough, of the Boston Gas Company, provides that any gas company may, by vote of two-thirds of the stock, engage in supplying electric light and power, and that lines of wire may be constructed in streets and highways, as the Mayor and Aldermen or selectmen may determine, and that where an electric light company was in operation, their poles might be used in consideration of suitable consideration, and that electric light companies may be consolidated with the gas companies. Mr. Greenough remarked that he should favor a clause to the effect that where existing companies were giving satisfactory electric lights the gas company shall not be given the power to furnish the same.

Mr. Dillaway submitted a draft of a bill much the same as Mr. Greenough's. Mr. Goodrich claimed that local authorities should be compelled to furnish locations for poles.

Mr. S. L. Powers, for the Cambridge Electric Light Company, said that the capital of the forty electric light companies in this State represented $3,500,000, the gas companies $12,000,000, and that wherever the price of gas had been reduced it had been due to an opposition company. Some gas companies had paid as much as 36 per cent. dividends yearly. They were afraid, notwithstanding their claims to the contrary, that electric light could be furnished as cheaply as gas. H. B. Parker, president Newton Electric Light and Power Company; E. H. Ashcroft, of Lynn, and Reuben Avery, of the Neaumkeage Cotton Mills, corroborated Mr. Powers' statements.

More power is distributed in Boston by electricity than in any other city, if not in the whole world. Present indications would seem to point out that in the course of a year over 1,000 horse-power will be distributed by electric motors. Among the more recent installations by the Sprague Motor Company are: John Goldthwait, 1 Purchase street, elevator, 10 horse-power; L. P. Hollander, Potter Building, Boylston street, two passenger, one sidewalk, one bundle elevator, 10 horse-power; Massachusetts Boot and Shoe Company, 654 and 453 Washington street, one ½ horse-power at each store; C. E. Morrill, 77 South street, ⅛ horse-power, and C. H. Codman & Co., 34 Broomfield street, 3 horse-power circular saw.

The Committee on Cities has given hearings relative to the Electric Police Signal system for the city of Boston. The Police Commissioners, who are now independent of the city government, as they are appointed by the Mayor, have been unable to obtain an appropriation for a police signal system, and have therefore applied to the Legislature. It is probable that it will result in the appropriation by the city of a sufficient sum for the purpose. Enlarged powers may be given to the Police Commission, in some degree equal to those school committees possess.

Citizens of the city of Worcester appeared last week before the Gas Commission, to complain of the quality of illuminating gas supplied them. One of the speakers said that four gas jets did not sometimes give enough light to read by; that the gas flame is nearly all blue, with but little illuminating power. The Worcester Gas Company began using an auxiliary water-gas plant about two years ago, and when a large proportion of this is mixed with the coal gas the illuminating power is reduced unless petroleum products are added.

BOSTON, MASS.

The resistance of a solution of sulphate copper decreases as the strength of the solution increases. For this reason the internal resistance of a gravity battery would not be lessened by employing anything weaker than a saturated solution in the lower part of the jar. The resistance of a solution of sulphate of zinc is least when the specific gravity is about 1.27, and when it is found by the hydrometer that this is exceeded some of the solution should be removed and replaced by water.

The Series Glow Lamps of the Schuyler Company, at Philadelphia.

At the late meeting of the National Electric Light Association, held at Philadelphia, in addition to its features of instructive and social intercouse, it will be remembered and noted as being the occasion of the first public exhibition of a series glow lamp in the strict sense of the term. That both Edison and Bernstein lamps have been constructed to run in series with each other on parallel circuits having a current intensity of three or four amperes is well known to everyone, and yet these were little more than an extension of the time-honored multiple series system.

During the days of the convention the rooms of the ELECTRICAL REVIEW were brilliantly illuminated with the Schuyler Series Glow Lamps of a different and entirely distinctive character. They were incandescent lamps of various candle power, varying from 20 to 250 candle power, when taking their normal current. These lamps were placed in series with the Brush arc lamps upon one of their regular city circuits; that is to say, in common with each of the arc lights. These small glow lamps received the entire current of 10 5 amperes of a Brush machine and were subjected to the same disturbances and variations that even the best regulated system extant is liable to. By a misunderstanding regarding the strength of the current of the particular machine upon which these lamps were to be placed, they were subjected to a 10.5 ampere current, instead of 9.6 for which they were designed.

Feeling, however, absolute confidence from a long experience with the lamps, Mr. Dalzell, the superintendent of the Schuyler Company, had not the slighest hesitancy in subjecting the lamps to the severe ordeal. The cause of this absolute confidence will be better understood when it is explained that each lamp was provided with an automatic fusible cut-out.

Mr. Linnell, the business manager of the Schuyler Company, extended an invitation to all the members of the Electric Light Association to meet in the parlors of the ELECTRICAL REVIEW directly after the afternoon session on Wednesday to witness the operation of the various safety fuses with which this system is provided. In order to demonstrate thoroughly the efficiency of the cut-out in the lamp, the bottom of the lamp was broken of several lamps, one after another; each filament as the air was admitted to the lamp burned for several seconds, the candle power becoming greater and more intense until finally the filament breaking, an arc was formed and the cut-out fused. Out of all the lamps which were broken in this way not one of the cut-outs failed to work, and we are informed by one of the inventors of this lamp, Mr. Wightman, that out of all the cut-outs which have been made from the beginning there has never been a failure on the part of the cut-out to fuse when any accident of any nature had happened to it.

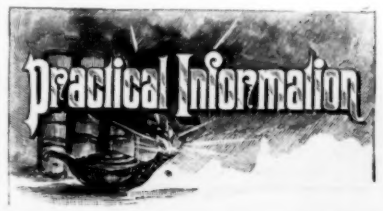
After breaking these lamps on the circuit, a lamp off the circuit was then broken leaving the filament bare. This was then placed in the circuit, with the same result. Although there has never been a failure on the part of these fusible cut-outs to act in case of accident, yet as an additional precaution, and to make an open circuit a still further impossibility, the circuit is additionally protected by another cut-out in the ceiling block.

President Morrison and Dr. Moses being unable to be at the afternoon exhibition, it was repeated for their benefit in the evening, and with like satisfactory results.

These lamps are being made for all currents and for all systems.

The entire outfit and all the apparatus which the Schuyler Company had on exhibition was sold when taken down to the Thomson-Houston Electric Light Company, of Philadelphia.

The test of these lamps as shown in Philadelphia on the Brush circuit proved hese to be equal in point of economy of any multiple series system of incandescent lighting which has heretofore been brought out.



To prevent belts slipping, fasten a piece of rubber belting around the pulleys.

To polish marble make a thick paste with rottenstone and olive oil, and vigorously rub the marble with it on a cloth.

The magnetic power of soft iron is more than twice that of lodestone and one thousand times that of ferric sulphate.

To remove a screw rusted in the wood, heat a poker in the fire redhot and put it on the screw for a minute or two. It is easily removed while still warm, by the screwdriver.

Cement for objects which have to be heated :

Iron filings,	100	parts.
Clay,	50	"
Common salt,	10	"
Quartz sand,	20	"

When screwing up the nuts on the ends of a rod it often happens that the rod will turn with the nut. To prevent this the nut on the other end must be kept from turning by screwing on a check-nut and a wrench on this will hold the rod while the first mentioned nut is screwed on.

To harden wood pulleys : Soft maple is often used in the construction of friction pulleys. If it is boiled in olive oil it will prove beneficial in a number of ways. It will harden the timber and render it less liable to split, and at the same time the gear will slip more after such treatment.

Cement for turners : Melt together beeswax, one ounce, resin, half an ounce, and pitch, half an ounce; stir in the mixture some very fine brickdust to give it a body. If too soft, add more resin; if too hard, more wax. When nearly cold make it up into cakes and rolls, which keep for use.

To preserve and renew the insulation power of ebonite or vulcanite supports, Mr. Varley suggests : First, washing the ebonite with water, and rubbing it well till dry; secondly, moisten the surface of the ebonite with anhydrous paraffine oil. To prepare this, put a quart of common paraffine and an ounce of sodium into a bottle.

Bruises may be taken out of the woodwork of scientific instruments by wetting with warm water. Then lay on the place brown paper about five layers thick, and apply a hot flat-iron until the moisture is evaporated. If the bruise is not gone repeat the process. If the bruise is small, merely soak it with warm water, and apply a redhot poker very near the surface. Keep the wood wet and in a few minutes the bruise will disappear.

When files have become clogged with oil and grease the best plan is to boil them for a few minutes in some strong caustic soda water. A little scrubbing with an old tooth brush will be beneficial before rinsing them in boiling water and drying before the fire. The "pins," which are so harmful to fine work, can be removed by a thin hard piece of sheet brass. These "pins" may to a great extent be avoided by using chalk on the file if it be used dry, or oil when that may be applied.

Cleaning brass : Make a mixture of one part common nitric acid and one part sulphuric acid in a stone jar; then place ready a pail of fresh water and a box of sawdust. Dip the articles to be cleaned in the acid, then rinse them in the water, and afterwards rub them with sawdust. This immediately changes them to a brilliant color. If the brass is greasy it must first be dipped in a strong solution of caustic potash or soda. This cuts the grease so that the acid has power to act.

Telephonic News

*** The post-office officials are making extensive experiments with a view to connect the whole of Germany by the telephone.

*** There is some opposition at Norwich, Conn., to the recent advance in telephone rentals. The increase is to $40 and $50 per annum.

*** Thirty telephone wires are going to be put up between Los Angeles and Pasadena as soon as the material arrives. Ten wires will be rigged up right away. The telephone traffic with Pasadena is reported as very heavy.

*** Underground bills are now occupying a good deal of the attention of the State Legislatures. We hope these political scientists will solve the problem for the electrical fraternity. Their efforts will certainly be appreciated.

*** The Sunset Telephone Company of California are engaged in putting up lead cables in the place of the cables heretofore used. The wires are contained in lead pipe, and by the use of the cable, induction is considerably reduced.

*** D. B. Macquarrie, Esq., formerly manager of the telephone exchange of Kansas City, Mo., has taken Horace Greeley's advice and "gone west," accepting the position of manager of the Los Angeles exchange. Mr. Macquarrie is an experienced telephone man, thoroughly master of the difficult work of construction, and will render good service for the Sunset Telephone Company.

*** The Columbus, Ohio, telephone exchange, at present located in the building at the southeast corner of High and Gay streets, is about to be moved into more commodious quarters, being the upper (fourth) story of the Roberts building, southeast corner of High street and Lynn alley. The telephone people hope to be in the new location by April 1st. A number of improvements are contemplated, including multiple switch-boards, etc., which will increase the facilities for handling business immensely.

*** Mr. A. B. Uline, of Albany, the very capable telephone general manager, is receiving political as well as telephonic honors. The *Argus*, in a recent issue, says: "The common council testified their appreciation of an able, faithful, vigilant, and thoroughly reliable official when they promptly and unanimously confirmed the name of Mr. Andrew B. Uline to be his own successor as fire commissioner. Mr. Uline has won an enviable reputation in the board by earnest, unremitting work, and the esteem and friendship of all his fellow-citizens who recognize in him those qualities of courtesy, kindliness and sterling worth that go to make up popularity."

*** The Worcester, Mass., Telephone Exchange has made a number of detailed improvements recently, liberal expenditures will be continued in the future in the interest of the best possible service. During the coming season additional copper wires will be run between the city and Boston, as there is more business between the two cities than can be done promptly at all times with the present wires. The number of poles in use and connecting it with adjoining towns is 5,225, extending over a distance of 165 miles; number of miles of wire outside of the cables, 871; in the cables, 127; total, 998 miles. Total number of wires leading to and from the Central Office, 298; number of subscribers, 655; average daily connections made at the Central Office, 2,365. The longest stretch of wire without support is from the jail on Summer street, over the jail garden to a cottage on Millbury street; estimated length, 675 feet. This is a mere trifle compared with the longest span of wire in the world, which it used for a telegraph in India, over the lever Kistnah. It is more than 6,000 feet in length, and is 1,200 feet high.

Our Rochester Letter.

To the Editor of Electrical Review:

Below I give the answer to the complaint in the case of the Bell Telephone Company, of Buffalo, against George H. Worrall and George Worrall served upon the plaintiff's attorney, George T. Parker, and the case has been noticed by both parties for trial at the March term of the Circuit Court. This suit was brought to recover $60.40 for the rental of an instrument from the time the telephone strike was commenced to the time of beginning the action, and is in the nature of a test case and will be of interest to telephone managers.

The first portion of the answer, in which the facts of the case are chiefly discussed, is as follows:

For a first answer or defense to the complaint of the plaintiff the defendants allege that before and at the time of the execution of the alleged contracts set forth in the complaint the plaintiff was in possession and control of a telephone exchange in the city of Rochester, and of a large number of wires connecting the exchange with over 900 places of business and residences in said city, and it had also a like number of telephones

FIG. 1.

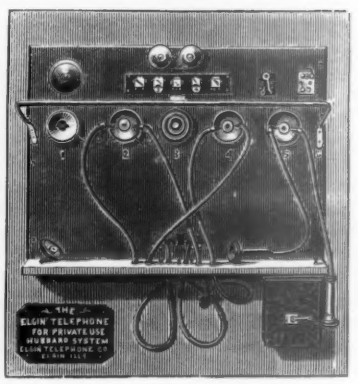


FIG. 3.

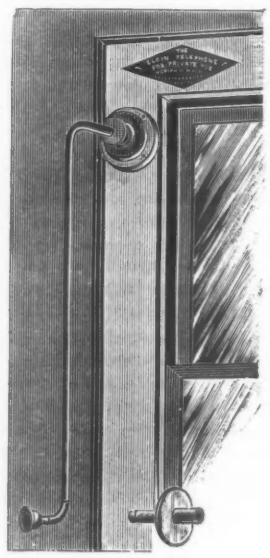


FIG. 2.

ELGIN ACOUSTIC TELEPHONE.

in said places of business and residences upon said wires for use by its patrons, and it held out inducements to defendants and to the public—the citizens of Rochester—to become its customers or subscribers. That a telephone is an instrument so constructed that by means of an insulated wire and magnetism, or some other force of nature—as clear as mud—the person in possession or use of it may employ a similar instrument attached to a wire connecting the two instruments to communicate with another person; and that at the time aforesaid, and before and after the execution of the alleged contracts between the plaintiff and defendants, the plaintiff had declared to the public the rates by the year for telephone service in Rochester, had published and had issued to these defendants a book in which it was represented that plaintiff then had an exchange in Rochester with 950 subscribers with a telephone upon the premises of each in Rochester, and that the rates for the use of telephones in the said city were uniform to its patrons and such as might become subscribers; that the established and published system was for the using or lease of said exchange and instruments by yearly rental at a fixed sum or flat rate, and that this was a matter of public knowledge induced and made known by the representations of plaintiff. That on or about the 15th day of June, 1886, defendants had been patrons of plaintiff by yearly contracts for over a year, and plaintiff proposed to defendants to renew their contracts for another year and so continue to be patrons or subscribers of plaintiff, as they had been heretofore, and that it was the duty and obligation of plaintiff to supply to defendants under said contracts, not simply the use of said instruments in and on their premises, but the use, through theirs, of its entire plant and all the telephones and service so controlled by plaintiff in said city, and that it was the duty of said plaintiff in said city under said contracts, to keep the said instruments in repair and the lines necessary for the use of the same in order and insulated, and in every way in their power to keep and maintain the plant as aforesaid, and the retention and use of all of said telephones and such others as other citizens might see fit to introduce into their houses or places of business; and that the plaintiff should not, by any act or omission of its own, do or allow any act or acts that would impair the usefulness of the said instruments or render their contracts with defendants, as aforesaid of no benefit to defendants or of so little benefit as to defeat the object of the said contracts between the plaintiff and the defendants.

Defendants further allege, upon information and belief, that the great body of subscribers or patrons of said company, to the number of several hundred, protested against said toll sheet and the terms thereof and such change of system, and the injustice, unreasonableness and extortion of the same were so apparent under the circumstances, that it became a matter of public denunciation and met the immediate condemnation of the public and of the entire press of the city and of the great body of the patrons of the plaintiff, of all which plaintiff was then duly notified, and that on the 20th of November, 1886, over 700 of the patrons of the said plaintiff closed their telephones, and would not, and did not allow them to be used, solely by reason of the acts of the plaintiff, and by its omission to do what was required to save the said plant, exchange and telephones to the use of the said defendants as so contracted for by plaintiff, and plaintiff by its acts and omissions thereby prevented defendants from using and enjoying the service and use of the said telephones and exchange, as it had so contracted to defendants, and from and after that date and until the commencement of this action, and now defendants have been and are and will continue to be deprived of the use of said instruments and the benefits of said exchange, greatly to their damage and in consequence of the violation by plaintiff of its agreements and contracts with the defendants.

The second answer alleges the waiver, abandonment and cancellation of the contracts. The third answer alleges a change of rates and system after the leasing for a year to defendants, which change, it is claimed, could not be made without defendants' consent or without the violation of the contract with defendants, and alleges such change and violation, and damages to defendants of over $100, which is a counterclaim. The fourth defense sets up the want of power or legal authority to make contracts in a telephone business, and denies that plaintiff had any authority to make the leases. It is a claim that the contracts were ultra vires.

The Newark Telephone Lines Sold for $200,000 to the New York and New Jersey Company.

Since the general introduction of telephones the system in Newark has been operated by the Domestic Telegraph and Telephone Company, which was organized in 1875 for burglar alarm and messenger service. It took up the telephone business when it was in an experimental stage. The capital stock of the company was $100,000, and many Newarkers, among them Edward Weston, of electric light fame, were directors and stockholders. The contract with the Bell Company contained a clause granting an extension of five years at the expiration of their charter in 1885, and when that time came an effort was made by the New York and New Jersey Telephone and Telegraph Company to take the field in Newark.

This brought on a suit in chancery and the Domestic Company was sustained. Three or four weeks ago the New York and New Jersey Company made overtures for an amicable settlement, and finally offered to buy out the telephone plant and business of the Domestic Company for $200,000. At a recent meeting of the directors of the Newark organization the bid was accepted. A final meeting of the Boards of Directors of both companies will be held, and the treasurer of the Domestic Company will transfer the business in exchange for a check for $200,000. The New York and New Jersey Company, with its main office in Brooklyn and its lines all over Long Island, had acquired privileges in all parts of New Jersey, except Newark, and this transaction gives a monopoly of the telephone service of the State, with the exception of a district near Philadelphia.

The "Elgin" Telephone.

Among the exhibits at the La Fayette Hotel during the session of the National Electric Light Convention was that of the "Elgin" Telephone (Wm. Hubbard, patentee, Elgin, Ill.) This telephone is fast becoming the standard acoustic instrument for private lines and is very popular with dealers throughout the country, who are handling them and putting them in their catalogues as a regular standard article, with which they can supply their customers with entire satisfaction.

Cut No. 1 shows the regular standard instrument. It is made wholly of metal nickel plated, durable, stand any climate, and is an ornament for any room. It is self supporting, not requiring a bracket or even a screw to hold it in position, and can be set at any angle, thus avoiding an angle near the telephone, which is so often considered a detriment to the perfect working of all acoustic telephones.

A special provision is made to avoid angles near the telephone, when it is necessary for the line to go out direct and then turn up several feet and then turn out again, in order to clear a passage on the outside, thereby making two right angles within a short distance from the telephone, as shown in cut No. 2.

Cut No. 3 shows the combination switch-board arrangement—either for a system of private club lines or an "Exchange Line System" in large factory or department buildings or in small towns.

Referring to the cut (No. 3); No. 1 is telephone without a mouth-piece, with the cap (having two tubes projecting through it at each side of the opening in the cap, on to which flexible tubes can be attached) removed; the cap is seen laying on the board shelf at the left; No. 2 and 4 show the caps on the telephones with a connection made through flexible tubes, by which the parties at the distant end of Nos. 2 and 4 can communicate directly with each other. No. 3 is the regular "Elgin" with mouth-piece, to which it is so arranged that a combination of a dozen or more distant lines can be put in communication with each other, using but the single instrument at the "central office," the calls coming in on regular annunciator loops, as shown near top of board. No. 5 shows cap with flexible tube attachments, designed only for use in very noisy places, the flexible tubes being placed, one at each ear, shutting out all outside noises, and the speaking being done through the central opening in the cap between the tubes.

THE ELECTRIC CLUB.

(*Continued from page* 3.)

ing space—and that a small fire kindled in the bottom of a brick elevator well. But whatever may have caused this particular fire, it was not due to the system of electric lighting. It was due merely to carelessness—the greatest difficulty we have to contend with. A system of electric lighting properly installed in the first place and carefully attended to afterwards is the safest method you can get anywhere. (Applause.) When we came to the settlement of the loss of the Providence Company, they asked us to let Captain Brophy serve as an expert with their electrician, to determine what the damage to the dynamos was. They were all soaked through. Heretofore we have paid heavily for similar cases, a dynamo wet through being represented to us as something utterly worthless. These people seemed to be entirely fair. They said whatever the loss was they wanted. They did not want any more. They started the dyn amos up, running them slowly, and they are running all right to-day, with the exception of one, the winding of which was burned. I do not know how the damage was finally settled, but the loss was very small indeed compared with the losses we have heretofore paid on dynamos.

Well, that damage without apparent fire has been claimed on us so much, that more than two years ago the rule was adopted in the New England Insurance Exchange, requiring all companies to attach to each policy insuring dynamos a clause reading this way: "This company shall not be liable for loss or damage occasioned by electricity unless fire ensues" I voted for that. I do not know what it means though. I do not know where electricity leaves off and fire begins.

The only thing you want to do to overcome this prejudice on the part of insurance companies that I speak of is to use all possible care at your central stations in preventing fire, and then if you get a fire from a good, legitimate cause, make your claim. But if through some carelessness of your own you burn out your dynamo, don't ask the insurance company to pay for it. Thereby you will overcome this prejudice, you will have no trouble in getting all the insurance on your dynamos you want, and you won't have to go into the insurance business yourselves.

Electricity Humorously Defined.

Mr. Weeks, 1st Vice-President of the National Electric Light Association: The birth and rapid growth of the Electric Club should be a matter of great gratification to us all for several reasons, but chiefly in that it has a strong tendency to promote good fellowship and fair dealing among all branches of our industry, and on account of its strengthening us and enabling us better to overcome the opposition that we have so long struggled against and which we will have to continue to struggle against for some time.

On behalf of the National Electric Light Association, I would express our thanks to your President and your Club for your hospitable entertainment this evening. I would further like to propose "Electricity," and before drinking the toast it might be well for us to have the term defined so that we can pledge it intelligently. To this end I have looked the matter up in the lexicographers.

I find that Webster defines it as follows: "A power in nature often styled the electric fluid, exhibiting itself when in disturbed equilibrium or in activity by a circuit movement, the fact of direction in which involves polarity or opposition of properties in opposite directions; also by attraction from many substances by a law involving attraction between surfaces of unlike polarity and repulsion between those of like, by exhibiting accumulated polar tension when the circuit is broken and by producing heat, light, concussion and often chemical changes when the circuit passes between the poles or through any imperfectly conducting substances or spaces. It is evolved in any disturbance of molecular equilibrium whether from a chemical, physical or mechanical cause."

Worcester thus defines it: "The invisible, subtle agent termed the electric fluid, produced by the friction of certain substances as amber, glass, sealing wax, etc., and so called from having been first observed in amber; a property in bodies when excited by friction of attracting or repelling other substances."

Johnson, Walker, Smart, and others have definitions which are fully as ambiguous as these, and seem to be simply a lot of verbiage to hide their ignorance, and I thought as the present conditions are peculiarly favorable for inspiration, if the President of the Club would call for definitions of the term, that we might get some that would be of material assistance to us.

The President: Mr. Weeks has offered a sentiment, and I will ask Mr. M. M. Slattery to respond to the toast and tell us what the great "what is it" is.

Mr. Slattery: After the erudite and comprehensive definitions of Walker and Webster, read for us to-night by Mr. Weeks, of what electricity is, I confess to considerable hesitation in advancing anything that would disturb the present state of things in that direction; and the only apology that I have to tender for making any remark at all is my desire for scientific accuracy.

As to the definition of electricity, sir, Webster and Walker, if they lived in these modern times that we are privileged to live in, would no doubt be able to advance to you a still more lucid definition than I shall to-night. It is a very serious problem, no doubt, as to what electricity really is, and it has unquestionably puzzled the gravest and most serious minds. But, after all, it seems to me a simple enough matter when proper consideration is given to it.

You are all familiar with this fact, that water, being a parabolic fluid, is readily converted into solid matter when its coefficient can be received back in the reflected image of the spectrum. What follows? The paleozoic electrical hypothesis naturally seeks a vacuum, which, combining with spinal meningitis, imparts electrical confusion to the perihelion of the democratic elliptic. (Applause and laughter.)

Prima facia and *a priori* the Hoboken theory must be implied parenthetically and diabolically, not forgetting to take into consideration the nitro-magnetic admeasurements of a similar incandescence of the carbon, together with its possible duration. (Laughter and applause.)

Dr. Moses: Gentlemen, as a guest, I have to thank you for the pleasure of being able to listen to such a pleasant interchange of conversation. Bacon has said: "Our conversation should be as a *field* that comes home to no man." As we are about to adjourn, I would reverse the quotation and say that our Field should be as a conver...tion to all of us on our way home. (Applause.)

Mr Field: Before we adjourn I would like to thank the Doctor for his kind allusion, and to suggest that there is a marked analogy between electricity and magnetism. To my mind they are both the same thing. Now we have had a very lucid definition of electricity, could the same gentleman favor us with a definition of magnetism? (Laughter.)

Mr. Slattery: At this time of the evening, particularly after the gastronomic and bacchanalian entertainment that we have had the pleasure of partaking to night, it is not an easy thing to maintain the continuity of a circuit, and in view of the possibility of an abnormal flow, with the hazard of a rupture of the circuit, I beg to defer that definition to a future occasion. (Applause.)

The Club adjourned and spent another hour in social mingling, all the guests of the evening registering in the Club's book of names of visitors.

An insulating plate for experiments in frictional electricity may be made from a piece of window glass of convenient size, as 8 by 10 inches. Thoroughly clean, warm and varnish with shellac on both sides. Attach silk loops as handles.

Our Arkansas Letter.

To the Editor of Electrical Review:

"The Pan Monster," as Mr. Dickerson names it, dies hard in Texas. Still the news from there is rather encouraging to us here, where we are struggling with the largest offspring of the beast in existence. They are trying to infuse new life into it at Dallas and Ft. Worth by dosing with "Elixir de Cushman." But with small show of success, as is evidenced by the fact that the Erie Co. was over 50 orders behind on the middle of this month, and more still coming.

Not being able to succeed otherwise, they are endeavoring to instigate some adverse legislation. No success so far, but there is no telling what a legislature may or will do. Prospects for extensions in territorial lines and general telephone business in this territory this spring are bright, provided no hampering laws are passed. * * * * *

We noticed in a local paper a very scientific and startling description of another wonderful discovery by the "Wizard of Menlo Park"—one that will probably astonish Mr. Edison when he sees it—being no less than the manufacture of all kinds of food and drink, bread, meat, and vegetables, wines and fruit, directly from the earth and water, without waiting on the seasons and nature's slow processes. It's electrical, of course, and "very simple," some crooked pipes, a tank, and "a wire connecting a few batteries" constituting the outfit. This equals the "electrical sword" with a fine platinum wire bedded in a steel blade and connecting with a small (but stout) battery carried in the belt. By simply touching an opponent with the weapon, and pressing a spring in the hilt, you send him to kingdom come instanter. Just how the circuits are completed, or what protects the bearer of the bottled lightning and "kill stuff" is left to the electrical imagination of the reader. Electricity is a great thing? * * * * *

We have got it at last. The solution of telephone opposition, deadheads, and all the other evils that trouble the telephone business. We mean a sure enough telephone call and toll register. We know it's O. K., because we invented it ourself. We have been working at it a long time—years—and at last our scattered ideas have solidified into a trick that does the work every time, and we have bribed the U. S. Patent Office by paying the regular fees, and as soon as we get our patent (and sell it) expect to roll in wealth. For any further particulars apply to us at our office. P. S.—We are in dead earnest, we have got it. * * * * *

We have received a new subscription list of the Pine Bluff, Ark., Exchange, with 107 names upon it, an increase of 31 since Sept. last. This shows well for both Pine Bluff and Mr. J. D. Oliger, the manager there. Among the rules and directions we notice one not to use the telephone during thunder storms, "as you might get hit in such a way that you couldn't hit back," which is pretty good advice. * * * *

J. K. Dunbar, General Superintendent Erie Telegraph and Telephone Co., came up from Texas the first of the month, but was recalled to Austin on important business as soon as he arrived. E. K. Baker, Supt. 1st District, is here, and has been most of the month, on business for the company.

Frank B. Knight, Special Agent Bell Co., stopped over one train on his way south about the first of the month. We wish more telephone men got down this way; we like to meet them. Yours,

Ruhtra.

Little Rock, Ark., Feb'y 21.

—— A bill has been prepared and will be introduced in the Legislature at Springfield, Ill., making an appropriation of $20,000 and providing for lighting the State House and grounds with incandescent electric light. It is estimated that this appropriation will more than pay the cost of the plant and fixtures, and run it for two years, and that the cost of lighting the entire building will be 50 per cent. less than the gas bills, which, for the past four years, have been $18,900. The bill will be bitterly fought by the Springfield Gas Company.

TELEGRAPHIC

.... At the annual meeting of the Municipal Signal Company, held last week in Boston, Col. A. A. Pope was elected President, Jno. C. Wilson Treasurer, L. M. Palmer Clerk. The company is in a most prosperous condition and has a large amount of business in sight.

.... The Kansas City *Journal* says: "This is a rapid city. Two mounted district messenger boys were arrested Tuesday for delivering messages too rapidly. We are gratified to observe that the cases against them were dismissed. Do not endeavor to moderate the speed of the messenger boys."

..... The Boston District Messenger Company, of which W. F. Chester is general manager, has contracted with the United Lines Company to deliver all that company's messages in the city of Boston. The Messenger Company has severed its connection with the B. & O. Telegraph Company, and its offices are now located at 178 Devonshire street.

.... Brooklyn is arranging to put police call boxes in four more precincts. Bids are advertised for and will be opened this week. There are sixteen booths with signal boxes, (the Gamewell system) now in satisfactory use. Mr. Fred. Mason, the superintendent of police telegraph, will soon have one of the most complete signal systems under his supervision to be found anywhere in the United States.

.... Last September Albertus Swain sent a telegram to W. A. Hallett, Neosha, Mo., but when it reached that place it read "W. A. Samett," and no such person could be found. Mr. Swain sued the telegraph company for damages, and the defendants were fined $100, the penalty for non-delivery of a message. An appeal was taken to the Supreme Court, but the latter reversed the decision, on the ground that the message was an unrepeated one, and the company could not guard against the effect of the weather upon its wires, which was the alleged cause of the failure to properly transmit the dispatch.

.... The electric well or pit in Taliaferro county, Ga., still continues to cure severe cases of chronic rheumatism. The well is located on the side of a small mountain four miles from the Sharon station, on the Georgia Railroad. It was dug last summer, in a search for gold. It is six or eight feet square and about fourteen feet deep, the bottom being covered over with loose boards and a rude carpet. Four chairs are at the bottom for persons to sit in. The owner has built a small house over the well. There is nothing like a shock, only a tingling sensation like that caused by a very weak current from a galvanic battery. The sensation is felt whether one touches the walls or not.

.... Mr. William Finn, of the Western Union Company, delivered a lecture on voltaic electricity, before the Buffalo Electric Society, recently, taking "Ohm's law" as the special topic. The economical and successful working of telegraphic and other circuits was found to depend mainly on the relation existing between the resistance of the battery and the external resistance of the circuit. Where the latter is great, the effect of increasing the battery resistance by adding more cells is of small account compared with the benefits derived from the augmented electromotive force; and it is for this reason that the batteries employed in telegraphy over long lines are arranged so as to increase the battery power in a greater ratio than the resistance of the circuit. On the other hand, where the outer circuit is of small resis ance, there is no advantage to be gained by increasing the electromotive force at the expense of augmenting the internal resistance of the battery, for in this case the two forces vary in about the same ratio, and the increased electromotive force is simply expended in overcoming the added resistance it brings along with it.

The Electric Subway.

Mayor Hewitt has asked the Corporation Counsel to draw a bill putting the construction of the electric subway into the hands of the Commissioner of Public Works. This bill will probably be introduced in the Legislature early next week. The Mayor's action is the result of an investigation made at the Mayor's instance during the past two weeks by Acting Mayor Beekman, Commissioner Newton and Corporation Counsel Lacombe, to ascertain if it would be for the best interests of the city that the powers of the Subway Commission should be extended by the Legislature. They reported that it should not.

Mayor Hewitt, speaking on the subject said he was of the opinion that the subways should be entirely in the hands of the city, just as the streets and sewers are.

Acting Mayor Beekman expressed the opinion that the franchise granted by the Commission to the construction company was one of the most valuable in the gift of the people, and one likely to become eventually of greater value than the Broadway Railroad enterprise.

President Edward Lauterbach, of the Consolidated Telegraph and Electric Subway Company, said that the passage of such a bill as is referred to would end the usefulness and the existence of his company, though he had no doubt it would be compensated for the work already done. They had paid $120,000 for the construction of the two miles of subway on Sixth avenue, and all their work was done in the best possible manner.

"I cannot help thinking it would be unfair to take the work out of our hands just now," he continued. "By the act of 1884 the city was empowered to compel the electric wires to be buried. So far from doing so, permits were granted almost daily to increase the number of wires strung overhead. In 1885 the Commission was created. The telegraph companies failed to present any plans within the prescribed sixty days. Then the Commission, having no money of its own to do the work, went to the Attorney-General, and he advised them that they could build the subways through a construction company, and drew a contract making proper provision for the public interests and guarding against monopoly or extortion. Our company got the contract because we were the only bidders that filed satisfactory bonds for half a million dollars There is no politics in our company."

The Griscom Electric Motor.

The new electric motor, of the Electro Dynamic Company, Philadelphia, which was invented by Mr. W. W. Griscom, is shown in sectional view on this page. The results obtained are said to warrant the belief that in spite of the heavy iron containing box—or perhaps on account of it—this motor is the most powerful for its weight as well as the most durable of any yet devised. The iron box is part of the magnetic circuit, and, consequently, there are no waste lines of force. The box also forms an efficient protection from the accidents which are apt to befall electrical apparatus in the hands of the classes who would need to use them as motors. From the measurements made by the Electro-Dynamic Company they state that it is possible to get one horse power from a motor of six inches cube, weighing less than 30 pounds. The commutator is kept clean and cool by the constant current of air which is forced outward from the hollow shaft, and all wearing parts are made unusually heavy to insure durability in the hands of the inexperienced. All the working parts are fastened in position by the act of closing the box, and they can be loosened by the simple act of opening it. A quarter turn of a thumb-nut serves to secure the box. The company state that they have obtained the somewhat unusual efficiency of 79 per cent., with a peripheral speed of 300 feet per minute.

* * Locate the steam gauge in a good light and keep its face clean, so that it will not require an electric light, a step-ladder and a telescope to tell where the needle points. Have it tested occasionally, that you may know if it is in proper working condition.

How to Construct Steam Plants for Electric Light Stations.

BY A. F. UPTON, BEFORE ELECTRIC LIGHT CONVENTION.

It is not intended in this paper to consider the subject of electricity or of electric lighting, except in such manner as pertains to the erection, equipping and running of central stations, either for arc or incandescent lighting, transmission of power or for street railways, and to the economical production of power for these purposes I wish to call your special attention. When we take a retrospective view of electric lighting, and consider the advancement made since 1879, it is astonishing to recall the fact that at that time there was not in existence in the whole world a central station for electric lighting. In 1878 the Brush Company made experimental tests at the Mechanics' Fair in Boston, and in 1880 they started their first central station in New York, which was followed by others in Albany, Baltimore, Cleveland, Boston, etc. To-day there is scarcely a city or town of 20,000 inhabitants in the entire country which has not a central station either for arc or incandescent lighting, and in many instances towns with a population of from 3,000 to 4,000 are supporting an electric lighting business. In starting a central station, the first matter to decide upon is a proper location, and this requires the consideration of a number of important questions, among which are convenience for coal and water supply and a location central to the lighting area. The site having been determined upon, the next question to be considered is the character of the building; brick would of course be preferable for both the boiler house and machinery building, but ordinarily the engine and dynamo rooms are constructed of wood and the boiler house of brick. In either case allowance should be made for increase of plant in the primary structures, and also sufficient land for increase of station buildings; for the inevitable necessity of this electric lighting business is to increase the plant, and the great mistake made by the pioneers of the industry has been in not allowing for this increase.

Size of buildings must be governed to a certain extent by the size of the city or town in which the station is to be located, but for an ordinary plant we find the following dimensions well adapted for the purpose; and our company has recently erected a station of these dimensions which is spoken of as a model plant.

The main building is of wood, two stories in height, with brick wall next to boiler house, and is 80 feet long by 36 feet wide; the dynamo and engine room is 16 feet in height in the clear, and the upper story (14 feet in the clear) is arranged to let power for manufacturing purposes if desired.

The boiler house is of brick, 40 feet by 40 feet, and 20 feet in height, allowing of nearly 10 feet between the boilers and roof, and in addition there is a large ventilator in the roof.

This plant starts with one tubular boiler, 6 feet by 16 feet, with ample room for two more of same size, and with proper passages at sides and rear of the boilers, and a 16 foot firing space in front, well paved with brick.

For a chimney they use an iron stack 70 feet in height, 42 inches in diameter at the base and enlarging to 48 inches at the top; this stack being of size sufficient for another boiler.

They have one high-speed engine belting direct to the dynamos (one belt from each pulley of the engine), and with room for five more, which will be put in as needed.

This plant is arranged for both arc and incandescent lighting, also to furnish power for an electric railway, and, when fully equipped, will easily develop 400 horse-power. There is also land sufficient to duplicate this plant.

Starting on the basis that the manufacture or production of electric lights was, in reality, merely selling power, we made it our aim to so equip these electric lighting stations to use such apparatus and fuel as would obtain the greatest amount of steam at the least possible cost, and to avoid as far as possible all loss between the boilers and dynamos.

The tubular boiler seems to be the standard among the electric stations, though many of the sectional boilers, especially the modern ones, have advantages well worthy of consideration.

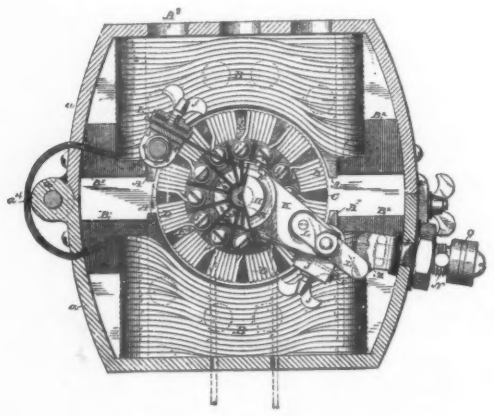
On the basis of tubular boilers, we say without reserve, put in steel every time; don't be satisfied with homogeneous steel, which can cover anything known as steel, but have specifications on flange or, better still, of fire-box steel of some good brand For the heads use flange steel. Don't put in a small boiler; a good 6 feet tubular costs but little more, takes up but a little more room, and the setting is but slightly more expensive than 5 feet, while the capacity is almost double.

In putting in the foundations of the boiler setting, put them in for two boilers; they will be needed later, and such work is inconvenient when running a station.

We say, as a matter of course, set the boilers on the Jarvis furnace and use the cheapest fuels you can buy. Let the projectors of any electric business take the trouble to investigate in their locality and see what cheap fuel can be procured: it is generally safe to say that they will find either slack coal, screenings, sawdust, wet tan, coke-screenings or similar refuse fuel, and every such opportunity should be taken advantage of. The question in selling electric lights is not how many pounds of coal per horse power, but rather what is your cost per light. How many pounds of water can you evaporate from your boilers for one dollar's worth of fuel?

On the point of economy among the Edison stations, where Mr. J. H. Vail, their general superintendent, has perfected a system of records from all their stations, by which accurate comparisons may be made, it is worthy of note that the highest stations on the list have their boilers set on the Jarvis furnace, and, using cheap fuels, the same result is being shown among the Thomson-Houston companies, where a similar plan is being adopted.

In setting the first boiler, build one outside wall as the middle wall for a second boiler: it is also wisdom to put in an iron stack (if iron is used) large enough for two boilers, and the first cost of a pump, heater and injector large enough for boilers is but little more than for one. For feeding the boilers we advise using both a pump and injector, using the pump in connection with a heater when the engine is running, having the injector, as a reserve feed, also to use to furnish the boiler with hot water in case the engine is not running. For boiler fittings we consider that a nickel seat pop safety valve is none too good, and it is very poor economy to attempt to save a few dollars at the expense of safety. A cheap set of grate-bars is sure to prove the dearest in the end, of anything about the entire plant; it costs more at first to put in a set of first-class rocking grates, or of stationary grates, but continuous running expenses are to be considered fully as much as first cost, and, to judge the future by the past, those companies which do not have their plants equipped in a manner to produce low-cost power will be obliged either to remodel their plants or be forced to the wall by the active competition which is springing up among the different systems.



THE GRISCOM ELECTRIC MOTOR.

To consider briefly the question of engines, I will state that we were the first to adopt what has since become almost the standard for successful electric lighting stations—the system of using small high-speed engines belting direct to the dynamos. We had experience first with the long-stroke engines, and were very soon satisfied, from the many objections arising, that some different plan must be substituted. In the first place, the friction of the large engines, necessitating the use of shafting, together with loss due to the extra belting, is nearly double what is shown to be the practice in running the small engines. Again, if it is desired to run a small number of lights, it is a waste of power to run an engine greatly out of proportion to the work. It is the case in many stations where the commercial lights are on a different circuit from the street lighting, that they are obliged to start and run a large engine from one-half to three-quarters of an hour, just for a few commercial lights, while, by the use of a small engine, the load could be adapted for the store lights, and the main lighting put on as required; and when time to cut out the store lighting, it is only necessary to shut down the engine running that circuit, and stop all expense pertaining to it.

If an engine gives out, the whole of the lighting is not stopped, as would be the case in the use of one large engine; and, in a station using a number of small engines, one reserve engine is practically a duplication of the engine power Referring to the economy of these small engines, I will read an extract from a report of a recent test made by Prof. Thurston at the station of the Narragansett Electric Lighting Company, at Providence, using A. and S. engines of 50 horse power each, and lamps of 2,000 candle-power. He reports as follows:

"When the engine was running without load, the steam consumption was 26.2 pounds per hour and per horse power; when driving the dynamo alone, 25.6; when 25 lights were on, 21 3; when 50 lights were on, the consumption was, according to the cards, 21.5 pounds. The economy of driving direct to the dynamo without intervention of countershafts is well shown by these trials. The expenditure of power was, in this case, but seven-tenths of a horse powe per light when fully loaded, while the power demanded when a countershaft is used is often reported to be 25 or 30 per cent. higher. With 60 lights in the circuit the power expended was, in this case, just 0.7 horse-power per light." The Armington & Sims engines, of which we act as selling agents, are made of both types—double disc engines with two wheels, arranged to belt direct to dynamos, and also single disc, with which it is necessary to use shafting; and the results of our extended experience have been such that I do not hesitate to say that we do not consider that a station with shafting can compete with any degree of success with one equipped to belt direct. In piping from the boilers to the engines, we place valves so that either boiler or engine may be shut down without interfering with the running of the balance of the plant; and in piping the primary portion of the plant, we put in the main steam and exhaust as near what the ultimate capacity of the station would require as can be determined. We also provide a muffling tank for the exhaust, where there is any question of the noise of the exhaust being the cause of trouble.

COMBUSTION.

The subject of combustion of fuel is of sufficient importance among the electric light people to merit a few general remarks on the matter, and it is a subject that is far less understood by steam users than any one would suppose, considering the cost of the fuel consumed in making the steam in this country, and the following facts should interest all parties using steam power:

1st. That coal is distilled into gas before it can be properly burned.

2d. That to burn this gas a sufficient supply of hot air must be introduced at a temperature not low enough to cool the gases below their igniting point.

3d. Every time a lot of fresh coal is thrown on the fire a great production of gas occurs, and if it is to burn to a flame it must have a corresponding supply of hot air. After a time, when the mass of fuel has become red hot, the supply of gas is greatly dimmished, but at first the evolution of gas actually checks the draft; but bear in mind that, although no smoke may be visible from the fire, it by no means follows that its combustion is perfect; if you diminish the supply of hot air, or reduce the air space of your grate bars, you will be merely distilling carbonic oxide gas up the chimney.

4th. In ordinary boiler furnaces there is an insufficient supply of air; fresh coal is put on the grates and the firing doors are closed; gas is being distilled from this coal. Now, if you do not furnish air above the fire (and it must be hot enough to ignite the gas) how can you expect to get combustion?

Whether it is expected or not it does not burn properly, and your boiler furnace is nothing more than as a gas retort in a gas works, making crude gas and wasting it up the chimney; in other words, a first-class soot and smoke factory.

Therein we claim the principle of the Jarvis furnace to be correct; it does furnish preheated air to ignite and consume these gases, and make flame and heat otherwise wasted in the chimney; and further, it allows of the use of fuel or a class of fuels that, in an ordinary furnace, will produce little else than soot and smoke.

SMOKE BURNING.

As most boiler furnaces are constructed they are nothing else but gas producers, that is, all gas producers are extra bad stoves or boiler furnaces. Consider how ordinary gas is made; there is a red hot retort or cylinder, into which you shovel a quantity of coal, which flames and smokes vigorously as long as the door is open; when it is full of coal you shut the door, cutting off the supply of air and extinguishing the flame. Gas is now simply distilled and passes along pipes to be purified and stored. You perceive at once that the difference between a gas retort and an ordinary boiler furnace with closed doors and half-choked grate bars is not very great.

Consumption of smoke, using bituminous coal: It is not a so-called "smoke burner" you really want, it is a fuel consumer. You distill your fuel instead of burning it in nine-tenths of your boiler furnaces. There is no such thing as "burning smoke." Once made, it cannot be burnt, and the only way I know of burning it is not to make it.

AIR FEED.

The question of supplying hot air, and the amount to be supplied at the right time, is a question that has puzzled the most scientific men who have made a study of this most important question. The Jarvis furnace is so constructed that the damper regulates the amount of air delivered into the boiler; if the full force of the draught of the chimney is required then the open damper allows a full supply; a half damper gives one-half the supply, and if the damper is closed no air enters the furnace over the fire. Every first-class steam plant should use a steam damper, and with such a damper the feed of hot air is perfectly automatic. The Jarvis furnace for setting steam boilers is constructed in the following manner:

It is the same principle as the Siemens-Martin furnace for making steel. In a different manner, and on a smaller scale, we pre-heat air (oxygen) and discharge it over and back of the fires, thus utilizing and igniting gases generally wasted. The joining of hot air with gases creates a draught and allows the combustion of low grade fuels that would otherwise require a draught to burn. Smoke is reduced to a minimum by this process. If the fuel is wet it is an advantage where hot air is used.

The principal thing to my mind in regard to electric lighting is the cost of power. I have always claimed from our experience that the matter of power in this regard was figured in one sense on a wrong basis. My idea is, to get at the bottom of all economy in electric lighting, the cost of power should be most carefully looked at. The only thing to be considered is the actual cost per lamp per hour, not evaporation of pounds of coal per hour. It is the actual cost of running an incandescent or arc lamp per hour.

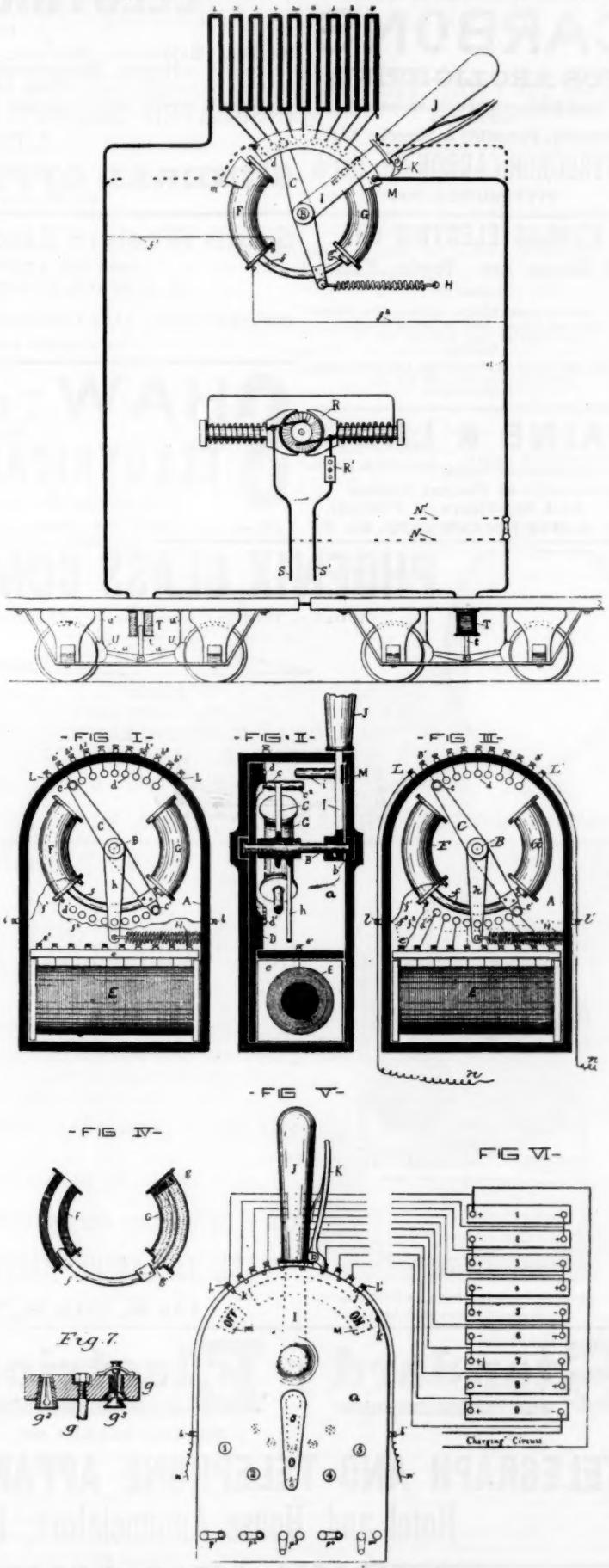
The only money to be made in the future in electric lighting under the coming competition is to be made in saving. Reduce the cost of fuel, use only the cheapest and lowest cost grades. Why use the highest cost coal when slack coal, screenings or pea coal can be purchased at one half price, and with proper furnaces evaporate the same amount of water as the highest grades of coal?

Such in general is my idea of what would be the best and most economical for an electric lighting station, and which is well shown in the blue prints. Should any member desire one of the prints, we will be pleased to furnish it. We have equipped some stations under conditions which required a great deal of ingenuity to accommodate a given power in limited room, of which the Edison Central Station of Boston is a striking case of what can be done. I have a full set of blue prints of that station, and it may interest some of the members to listen to a general description of what has been done there.

I will say respecting this station and these plans, that although we did the work of fitting out the station, the design work and plans were made by, and done under, the supervision of the engineering department of the Edison Company, and I am indebted to Mr. J. H. Vail, General Superintendent of that company, for his courtesy in furnishing the prints and allowing me to exhibit them.

A New Electric Brake.

The brake of E. E. Ries, of Baltimore, Md., is illustrated in this issue, showing the means employed for automatically controlling and regulating the admission of the electric current to the brake apparatus. Mr. Ries employs in the brake circuit an automatic circuit closing device, provided with two independent levers, one of which is under the control of the engineer, and determines the extent to which the brakes shall be applied; the other is automatic in its action, and, when the first lever is moved, operates to transmit and gradually increase the flow of current to the electro-magnetic brake devices until they have reached the strength determined by the first lever. By this means the brake devices are not only protected from sudden strain, but when the same, with the cover and switch lever in place. Fig. 3 is a view similar to Fig. 1, except that this view shows the interior connections when it is intended to regulate the current transmitted to a derived working circuit from a main working circuit, or to transmit the direct current from a suitable generator to one or more translating devices that require a gradual application of the current. Fig. 4 is a detail sectional view of the automatic regulating and governing



SECTIONAL VIEWS OF THE RIES ELECTRIC BRAKE.

speed of the transmitting lever is once properly adjusted, the brakes can be applied, and the train brought to a standstill within the shortest possible space of time. Fig. 1 represents a sectional elevation of the inclosing case of the regulating and governing apparatus, giving a general view of the interior, and showing the connections when it is intended to be used to regulate the current from a primary or a secondary battery. Fig. 2 is a sectional end elevation of the devices. Fig. 5 is a front elevation of the apparatus, showing the switch-lever and the arrangement of circuits when used in connection with the cells of a secondary battery. Fig. 6 is a diagram view of a secondary battery, illustrating the method in which the cells are connected to the binding posts leading to the upper row of contacts of the apparatus. Fig. 7 is an enlarged sectional view of the dash-pot piston and its openings.

ELECTRIC LIGHT NEWS

—— A central station plant for incandescent lighting is proposed for Mobile, Ala.

—— New Orleans is discussing the question of granting a franchise for adopting the tower system of electric lighting.

—— The Racine Gas Co., Racine, Wis., is going into electric lighting, and has ordered a 60 H. P. Westinghouse engine.

—— The Lynn, Mass., Electric Light Co. are increasing their plant materially, and have just ordered a fifth Westinghouse engine of 100 H. P.

—— Harrisburg, Pa., has decided to increase its lighting plant, and has ordered additional lamps from the Excelsior Company, which operates in that city.

—— The Fort Wayne Jenney Electric Light Company has received permission of the City Council of Wilmington, Del., to erect an electric light plant in that city.

—— The American Company have recently established a general agency in Canada under the management of A. R. Williams, the machinery agent of Toronto, Canada.

—— The American Electric Light Company has leased the entire first floor above the street floor, of the new building of the Metropolitan Telephone Company on Cortlandt street. This building will be lighted by the Edison Company.

—— The electric lighting of the Cathedral at Milan, Italy, was inaugurated on Christmas Day. The current is supplied from the Edison central station, the plant in the cathedral consists of fifteen 32 candle power Edison lamps, three 16 candle power, and seventy-seven 10 candle power lamps.

—— Among other changes and improvements going on in Chattanooga, Tenn., is the Brush Electric Light Company, which has recently been purchased by D. W. Hughes and associates, who are going to enlarge the plant quite largely, and have recently purchased two 12x12 automatic engines from the Ball Engine Company of Erie, Pa.

—— The Mutual Electric Manufacturing Company, of Brooklyn, with offices and factory at the corner of York and Washington streets, is manufacturing the Knowles arc and incandescent electric light systems, Knowles' automatic fire alarm and the Julien motors, besides general electrical appliances. Mr. Theo. F. Otis is president and general manager, and Mr. E. R. Knowles, the inventor of the systems bearing his name, is the electrician and superintendent.

—— The Schuyler Electric Light Company during the past week have received orders for their series incandescent lamps from Kansas City Electric Light Company, Kansas City, Mo. (Thomson-Houston system); Jamestown, N. Y., Electric Light Company (Brush system); MacKeesport Electric Light Company, MacKeesport, Pa. (Thomson-Houston system); Thomson-Houston Electric Light Company, Philadelphia, Newton Electric Light Company, Newtonville, Mass. (Thomson-Houston system), in addition to their orders from the local companies using the Schuyler system.

—— The American International Electric Light Company, limited, has been organized to operate under all the patents of the American system in all countries foreign to the United States and America.

— Mr. Wm. Whitney Monroe, former secretary of the Thomson-Houston International Company, has accepted the position of secretary and general manager of the new company, and for the present will have his office with the American Company, 146 Broadway in this city. Mr. Monroe is a live electric light man, well informed in this special field, and will undoubtedly build up an extensive foreign business for the American Company.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING FEB. 22, 1887.

358,019 Electric battery jar; Charles G. Curtis and Francis B. Crocker, New York, N. Y., assignors to the C. and C. Electric Motor Company, of New York.

358,030 and 358,031 Galvanic cell; William Frishmuth, Philadelphia, Pa., assignor, by direct and mesne assignments, to Rudolphe de Montgelas, William H. Gaw, J. Hinckley Clark, Rudolph Ellis, Henry Jungerich and George C. Potts, all of same place.

358,043 Transmitting gear for electric motors; Walter H. Knight, New York, N. Y.

358,053 Electrical pumping apparatus; Moses A. Michales, Allegheny, and Albert Michales, Pittsburgh, assignors of one-fourth to John B. Sneathen, Pittsburgh, Pa.

358,087 Galvanic battery; William H. Tasker and Thomas J. Jones, London, assignors to the Primary Battery Company, Limited, Hanover square, county of Middlesex, England.

358,092 Secondary electric battery; Jean Th. van Geistel, New York, N. Y.

358,095 Manner of making and cooling joints for electrical conduits; Benezette Williams, Chicago, Ill.

358,111 Manufacture of plates or elements for voltaic batteries; Desmond G. Fitzgerald, Brixton, county of Surrey, assignor to the Primary Battery Company, Limited, Hanover square, county of Middlesex, England.

358,120 Voltaic battery; Thomas J. Jones, Hanover square, county of Middlesex, England, assignor to the Primary Battery Company, Limited, same place.

358,131 Pump for producing high vacua; Elihu Thomson, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut.

358,133 Regulator for dynamo-electric machines; Francisco Vivoy Graells, Barcelona, Spain.

358,145 Electric arc lamp; Walter A. Crowdus and Henry M. Sutton, Dallas, Texas.

358,161 Electrical gas alarm; William McVay, Quincy, Ill.

358,250 Telephone annunciator; John A. Barrett, Brooklyn, N. Y.

358,310 Dynamo electric machine; Rudolf Eickemeyer, Yonkers, N. Y.

358,314 Electric battery: Schuyler S. Wheeler and Charles G. Curtis, New York, N. Y., assignors to the C. and C. Electric Motor Company.

358,309 Switchboard for electric light systems; Geo. H. Warde, Brooklyn, assignor of one-half to Alexander MacGruthar, New York, N. Y.

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"In making the statements which follow we can verify each and all of them as facts. Mr. Edward P. Thompson, of Temple Court [7 Beekman St.,] New York, is a good man to bring your patent cases to, for he is thoroughly versed in all the ins and outs of a Patent Attorney's duties. The following are some of his qualifications: Graduate of Stevens Institute as Mechanical Engineer. For four years tutor of classes of young men in mathematics and experimental physics at Elizabeth, N. J. Served professionally as Electrician and Chemist in the Swan Electric Company of New York for two years. Because of past successes as a Patent Attorney at 13 Park Row, New York, was appointed, to succeed N. S. Keith, of the patent agency of the *Electrical World* and Associate Editor. N. S. Keith is known as the Translator and Reviser of Schellen's Treatise on "Dynamo Electric Machinery." Mr. Thompson for two years personally prepared and prosecuted all the patent business of *Electrical World*'s Patent Agency, and is the author of a series of articles in said paper upon "Analytical and Systematic Method of Inventing," which were widely known and favorably received. Mr. Thompson is a member of American Institute of Electrical Engineers and American Society of Mechanical Engineers. He is author of the "Expansion of Polynomials," which the ablest mathematicians of the world universally commend." —*New York Observer*.

ASSIGNEE'S SALE.

The undersigned will offer at public sale, on the premises, Bridge street, Sharpsburg, Pa., on Tuesday, March 15th, at 2 o'clock P. M., the equipment and machinery of the Brilliant Carbon Co., Limited, consisting of 1 three-light McTighe dynamo and lamps; 1 grinding mill, 1 set iron rolls, 1 emery wheel and frame, 1 scraping machine, 1 three-plunger hydraulic pump, 1 two-plunger hydraulic pump, 1 fourteen-inch hydraulic press, upright, 1 large horizontal press and moulds, 9 carbon moulds, 6 plating vats, complete; 6 iron tumbling barrels, and such other tools and machinery in use in a first-class carbon works; also lot of carbons. Works equipped with natural gas, and 3 carbon furnaces. Good shipping facilities by three railroads. Open daily for inspection. Offers for the whole at private sale will be entertained until day of sale.

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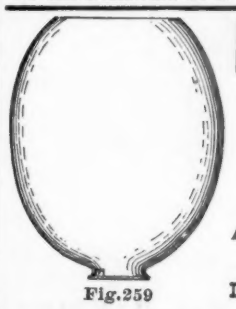
Fig. 259

PHOENIX GLASS COMPANY,
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Fig. 255

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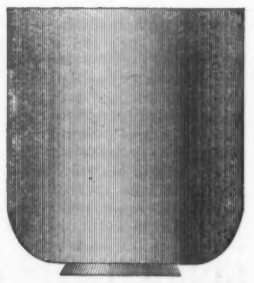

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